ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 1.] [1907.

I.—PLANT DISEASES.—VII. "CLUSTER-CUP" DISEASE OF CONIFERS.

(*Calyptospora Goeppertiana*, Jul. Kühn.)

(With Plate.)

G. MASSEE.

The term "cluster-cup" is used popularly in this country to designate the Aecidium-form of fruit of many of the "rusts" or Uredines. It appears in the shape of tiny white cups with frilled edges, filled with yellow spores, growing in dense clusters on the living leaves of many of our wild and cultivated plants. The fungus causing this disease is one of those parasites which, when opportunity offers, grows on two different kinds of host-plant during different periods of its development. The resting-spore stage grows on *Vaccinium*, and the "cluster-cup" stage on various conifers.

It has been proved, however, that when conifers are not forthcoming, the "cluster-cup" or Aecidium-stage can be left out of the cycle of development of the fungus, which continues to reproduce itself entirely on its *Vaccinium* host. On the other hand when *Vaccinium* and conifers grow together, the fungus certainly passes from the former to the latter, and often proves very destructive to young trees and nursery stock, causing defoliation early in the season. It may be mentioned that in some other "rusts" or Uredines, to which group the present fungus belongs, the Aecidium- or "cluster-cup" stage may drop out without in any way interfering with the continuation of the species. This frequently happens in the case of a rust of wheat—*Puccinia graminis*, DC. In many other rusts the "cluster-cup" stage has been permanently left out of the cycle of development.

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In Europe the resting-spore condition of this fungus has only been met with on the Cowberry—*Vaccinium Vitis-Idaea*, L. In addition to this host it also occurs on *V. Myrtillus*, L., and *V. Chandleri*, Jepson, in the United States. It has been recorded as occurring on *Salix* in the United States, but an examination of the specimen in the Kew Herbarium on which this report was founded, shows that the plant is *Vaccinium Vitis-Idaea*, L.

The "cluster-cup" stage occurs spontaneously on the Silver fir—*Abies pectinata*, DC., and on *A. Nordmanniana*, Spach. Infection experiments have shown that the fungus will also develop on *Abies nobilis*, Lindl., *A. magnifica*, A. Murr., *A. concolor*, Lindl., *A. balsamea*, Mill., *A. Fraseri*, Lindl., *A. cephalonica*, Lond., *A. cilicica*, Ant. & Kotschy, *A. Pictita*, Forbes, *A. Pinsapo*, Boiss., and *A. Veitchii*, Lindl.

On the other hand *Tsuga canadensis*, Carr., and *T. Douglasii*, Carr., have resisted all attempts at infection.

The appearance presented by Cowberry plants when diseased is very striking. All the branches grow perfectly erect, the entire plant grows much taller than uninfected plants, and the leaves are much stunted. The fungus attacks the stem, which becomes much swollen and spongy in texture. The colour of the swollen stem is at first clear pink, gradually changing to brown and finally almost to black. The resting-spores or teleutospores of the fungus are produced in the epidermal cells of the swollen stem, and in the spring following the period of infection, germinate *in situ* and send delicate threads through the epidermis of the host-plant into the air. These threads bear very minute secondary spores, which are scattered by wind. Some of these spores alight on the stems of other Cowberry plants, and the same cycle of development is repeated. If young conifers happen to be growing near a diseased Cowberry plant, and the spores from the latter settle on the conifer leaves, the "cluster-cup" stage of the fungus develops and the spores it produces can infect neighbouring Cowberry plants, but cannot directly infect another conifer.

The Silver fir—*Abies pectinata*, DC., suffers most from the disease in this country, and also on the Continent; diseased specimens of *A. Nordmanniana*, Spach, have also been received from Wales.

In conifers the leaves only are attacked. About a month after infection two rows of white, cylindrical "cluster-cups," about half a line in length, appear on the under surface of the leaf; these "cluster-cups" or peridia are the fruit of the fungus and are filled with minute orange spores. Infection usually occurs in May, and by the middle or end of July diseased leaves have become yellow and soon fall. After the spores have been blown away, the silvery-white empty "cluster-cups" resemble the eggs or empty remains of some minute insect, for which they are frequently mistaken.

Preventive measures are alone of service in combating this disease. In selecting a site for a seed bed or nursery, it is important to ascertain that no diseased Cowberry plants are growing in the neighbourhood. Such can be readily detected when growing amongst healthy plants from the description given above.

The same rule applies when young conifers are planted in woods or other places where the Cowberry grows. If the diseased plants are not numerous, they may be removed and burned.

Description of Figures on Plate.

Left-hand figure : A branch of Silver fir bearing the minute "cluster-cups" on the leaves.

Right-hand figure: Cowberry plant showing the upright branches much thickened by the fungus present in the tissues.

Left-hand lower small figure : Portion of leaf of Silver fir bearing "cluster-cups" on its lower surface.—Mag. 5 times.

II.—THE CHINESE SPECIES OF ERIOCAULON.

C. H. Wright.

The following clavis to the Chinese species of *Eriocaulon* was drawn up as a result of the examination of the specimens employed in working out that genus for the "Index Florae Sinensis," the plan of which did not allow of its inclusion therein.

All the species, except *E. Henryanum*, occur only in the eastern half of the empire, and their number in each province is as follows :—Kwangtung, 11 ; Hongkong, 6 ; Chekiang, 5 ; Kiangsi, 2 ; Shantung, Formosa, Hupeh, Yunnan and Hainan, 1 each. Of these species, no less than 10 have been recorded from single provinces only, 3 from two, 3 from three and 1 from four. *E. Faberi*, *E. Henryanum* and *E. sinicum* are confined to China ; *E. Buergerianum*, *E. Miquelianum* and *E. nipponicum* extend to Japan only ; *E. australe* and *E. cinereum* to Australia only ; *E. alpestre*, *E. echinulatum*, *E. luzulaefolium*, *E. setaceum*, *E. Wallichianum* and *E. Wightianum* to British India only (3 southwards to Ceylon) ; *E. truncatum* to British India and Malaya ; *E. Sieboldianum* to British India, Malaya and Japan. The type of *E. cristatum* occurs in Northern India and Japan. No species is recorded in the enumeration of Tibetan plants in the Journal of the Linnean Society, vol. xxxv. Thirty-six of the well-ascertained Indian species do not occur in China. *E. officinale*, Koern., an imperfectly described plant, is only known as an ingredient of a Chinese medicine.

Caulis elongatus, foliis dense obtectus — 1. *E. setaceum*, Linn.

Caulis brevis, folia radicalia :—

Bracteae involucrantes floribus longiores :—

Flores dimeri . . . . . 2. *E. nipponicum*, Maxim.

Flores trimeri :—

Bracteae involucrantes acuminatae, rectae . . . . . 3. *E. Miquelianum*, Koern.

Bracteae involucrantes apice cuspide longa recurva instructae . . . . . 4. *E. echinulatum*, Mart.

Caulis brevis, folia radicalia—*cont.*
Bracteae involucrantes floribus non longioribus :—
Folia pilosa . . . . . 5. *E. australe*, R. Br.
Folia glabra :—
Bracteae involucrantes villosae . . . . . 6. *E. Wightianum*, Mart.
Bracteae involucrantes glabrae :—
Sepala ♂ dimera :—
Bracteae florales acutae . . 7. *E. sinicum*, Miq.
Bracteae florales obtusae . . . . . 8. *E. truncatum*, Ham.
Sepala ♂ trimera :—
Antherae nigrae :—
Sepala ♀ libera :—
Corolla ♂ tubulosa, glabra :—
Receptaculum pilosum . . . . . 9. *E. luzulaefolium*, Mart.
Receptaculum glabrum . . . . . 10. *E. Wallichianum*, Mart.
Corolla ♂ tubulosa intus pilosa . . . . . 11. *E. cristatum*, var. *brevicalyx*, Wright.
Corolla ♂ tubulosa apice ciliata . . . . . 12. *E. Henryanum*, Buhl.
Sepala ♀ connata :—
Bracteae involucrantes semiorbiculares . . . 13. *E. Buergerianum*, Koern.
Bracteae involucrantes ovatae :—
Folia 5 mm. lata . . . . . 14. *E. alpestre*, Hk. f. & Thoms.
Folia 2 mm. lata . . 15. *E. Faberi*, Buhl.
Antherae albae :—
Corolla ♂ ciliata . . . 16. *E. cinereum*, R. Br.
Corolla ♂ glabra . . . . . 17. *E. Sieboldianum*, Sieb. & Zucc.

III.—RAMIE IN TIRHUT.

(*Boehmeria nivea*, Hook. & Arn.)

In the *Agricultural Ledger*, 1898, No. 15, pp. 37–46, Sir G. Watt, in dealing with the cultivation of Rhea or Ramie in Bengal, indicated the extent to which it was then actually grown in that province. He remarked particularly the suitability of the plant to the north-eastern districts of Rungpur, Jalpaiguri and the Duars, and indicated the possibility of an extension of its cultivation westward to Tirhut, though at the same time he pointed out that how far this extension was really possible was for the future to show.

Considerable interest, therefore, attaches to the experience of an association formed in Calcutta in 1900 for the purpose of putting on the market Ramie fibre in a commercial form. This association,

the Bengal Rhea Syndicate, entered into an agreement with various planters in the district of Durbungah, in Tirhut, under which the growers were to put a definite area under Ramie, and provide Rhea stalks, the syndicate supplying the necessary machines to produce from these the commercial fibre. It has long been known that there is no serious difficulty attending the cultivation of Ramie, provided the soil is suitable and the climatic conditions are at all favourable. As has already been pointed out (*Kew Bulletin*, 1888, p. 298), the chief difficulty is as regards the decortication of the Ramie stalks. The experience in Tirhut is therefore of further interest as throwing light on such practical advances as may have been made in this direction.

That the plant could be successfully grown in Tirhut on an experimental scale was already known; various planters in Tirhut had demonstrated this in plots containing plants raised from roots supplied from the Royal Botanic Garden at Calcutta, and to a smaller extent from the Botanic Garden at Saharanpur. But what Sir G. Watt had in view, and what it was desirable to test was whether, if the difficulties attending decortication were overcome, the cultivation of the plant in Tirhut was likely to prove remunerative commercially. The original contracts entered into by the syndicate in question were nine in number; the area involved amounted to 3,700 acres. Actually, however, owing to difficulties connected with soil and rainfall, operations had to be restricted to seven concerns with an aggregate area of 3,100 acres, and of the suitable available land the amount actually under Ramie, in February, 1906, was 1,950 acres. The results of these operations, which have now extended over several years, are calculated to throw some light on both questions.

These results have been made generally available by the publication in the *Journal d'Agriculture Tropicale* for June 30, 1906, of the French text of an account of the operations, which is there stated to have been supplied on February 10, 1906, to the Director of Agriculture, Bengal, by Mr. J. Karpelés, the managing director of the Bengal Rhea Syndicate. The original agreement entered into by the syndicate with the planters in Durbungah stipulated that the growers were to produce the Ramie stalks, while the syndicate were to supply the machines for preparing the commercial fibre. The fact that the firm in Calcutta to which the syndicate's managing director belongs acted as agents in India for the machine especially devised by Mr. Faure for dealing with Ramie, adds further to the interest of the account.

In the *Queensland Agricultural Journal* for November, 1906, p. 247, is given a translation of the report referred to, which is here reprinted. Its value is considerable owing to the fairness with which the results obtained and the difficulties encountered by the Bengal Rhea Syndicate have been stated. But, as pointed out in the *Queensland Agricultural Journal*, it possesses another interest—it gives for the first time, so far at least as India is concerned, an account of operations on a scale sufficiently extensive to justify the formation of reliable estimates for a plantation :—

"At the outset there was considerable difficulty in procuring the necessary quantity of plants to establish the plantations. Some small lots of stocks (rooted plants) were certainly obtained from

various localities, notably from Assam, and from sundry Indian botanical gardens, but these supplies were insufficient in quantity, and often of bad quality; it therefore became necessary to establish on each farm a nursery for the multiplication of rhizomes.

"The plantations suffered much from the attacks of white ants, which rapidly destroyed the young roots, and especially the cuttings. The planting of cuttings, however, during the rainy season obviated to some extent this inconvenience, but still the best method of reproduction is the division of the rooted plants. Portions of the rhizomes may be taken from one- to two-year-old plants without injuring them.

"It was evident from the commencement that successful plantations could only be established on light, porous soils; saltpetre and alkali soils are not conducive to the successful production of Ramie. On well-cultivated lands, where noxious weeds had been carefully eradicated, every root produced annually 15 to 30 stalks, about 5 feet in length, whilst in a field left as an experiment without cultivation produced only from two to five stems per plant; the plot in the same field, called the 'control plot,' which had been weeded and cleaned, gave 10 to 15 stems. It will thus be seen that a Ramie field must be well cultivated, in spite of the increased expense, the field having to be cleaned by hand labour to avoid damage to the roots and young shoots.

"In the three-year-old well-cultivated fields, no sign of soil exhaustion has yet been observed, although the upper part of the root has a tendency to become woody, to the detriment of the development of new stems. To overcome this, it is intended to remove the lignified portion every year, in order to rejuvenate the plants. Experience alone will decide if this is a good idea.

"Ramie is a very exhausting crop, and, therefore, the question of manure must be carefully studied, for unmanured plants yield a very poor crop. Good results were obtained by the use of indigo refuse. It is said that the refuse of Ramie itself, such as the leaves, bark, and wood, constitutes a perfect manure, sufficient to restore to the soil the constituents taken out of it by the crop. But, up to the present, no experiments in this direction have been possible, as nowhere has the decortication of the stems been carried on in a systematic manner. However, at Dalsing Serai, a manure consisting of decomposed Ramie refuse was applied to the experimental plots with excellent results. It has not yet been determined what quantity of such manure is needed. At Dalsing Serai and Mooktapore, where respectively 60 and 40 acres are in full bearing, there is a sufficiency of fermented material which will be utilised for manure. The leaves, separated from the stems when the latter are cut, are left on the ground, and these form a good mulch for the roots, at the same time supplying a manure.

"Ramie requires a good deal of moisture to properly develop, but water must not be allowed to remain too long on the ground, as the rotting of the roots would probably be thus caused. This was the unfortunate experience on plantations established on the low, flat country, where, last September (1905), many hundreds of acres were destroyed in consequence of the heavy rains. Ramie requires at least 45 inches of rain per annum. Two plantations had to be abandoned in a district where the annual rainfall did

not exceed 35 inches. Consequently, cultivation was only carried on on seven plantations, representing an aggregate area of 3,100 acres, of which 1,950 acres were planted up to February, 1906. The remaining 1,150 acres will, we are told, be planted during the next rainy season.

"It is very important to cut the stems at the proper time. If they are cut too soon, they yield a very fine fibre, but in small quantity; if cut too late, the decortication becomes more difficult, and the fibre is brittle. The best time to cut is when the base of the stem is of a brownish tint for a height of about 10 inches. The stems must be worked up immediately they are cut. The decortication is much more readily performed if carried out within twelve hours of the cutting. When they have been allowed to dry decortication is more difficult, and the fibre is inferior. If circumstances render it necessary to defer decortication, the stems, having the leaves removed, are made into little bundles of thirty or forty, and preserved in water, where they will remain unchanged for forty-eight hours.

"Fibre containing 30 per cent. of gum does not easily dry in the climate of Bengal. The syndicate has, therefore, been obliged to have special drying apparatus constructed in Paris, and installed on each plantation. The fibre on leaving the decorticating machine passes first through a centrifugal drier, made by Dehaitre, which removes 70 per cent. of the water it holds. It is then hung up in a large closed-in straining-room, supplied with a current of warm air set in motion by a fan.

"The fibre, when ready, must be at once baled, for it readily absorbs a quantity of fresh moisture from the air, which would soon produce fermentation and mouldiness. At Dalsing Serai a hand press is used.

"A 20-h.p. engine is sufficient to drive all the machines required for 500 acres. As the fibre has to be washed as it passes through the decorticators, a good and sufficient water supply is indispensable.

"The fibre must not be twisted, as this imparts to it a permanent undulation which depreciates it from the spinner's point of view.

"Many samples of Ramie fibre produced by the syndicate were sent to Europe to several spinners. They were considered quite equal in quality to China grass, and very shortly orders were received totalling 1,500 tons. Some 20 tons of better quality fibre, more carefully prepared than hitherto, have been lately exported from the syndicate's estates.

"From a forecast of the next year's crop (1906) the syndicate should be in a position to deliver at least 200 tons of fibre from the 1,950 acres already under cultivation. This is said to be a very moderate estimate, since the normal production from this area will be, it is estimated, 800 tons when in full maturity.

"It is the intention of the syndicate, in the near future, to de-gum the fibre as well as decorticate the stems, in order to save the freight charges on 30 per cent. of gummy substance contained in it. But, as every spinner of Ramie has his own particular method of de-gumming, all of them require the fibre to be delivered to them without its having been subjected to any

chemical treatment. It is hoped, however, that flax spinners will some day take up Ramie as well, and will accept the fibre de-gummed on the plantation."

In connection with this account of the operations of the Bengal Rhea Syndicate, the *Queensland Agricultural Journal* publishes certain critical remarks on the prospects of successful cultivation of Ramie in Queensland. But Queensland is not the only colony where there are considerable areas with climatic conditions approximating to those that are known to prevail in Tirhut, and the questions raised in the *Journal* deserve consideration by those who contemplate the extensive cultivation of Ramie elsewhere. These remarks are therefore reproduced below.

"From the above account of the operations of the Bengal syndicate, we can form some idea of the initial difficulties to be encountered in entering upon Ramie cultivation. After six years' work the company has 1,950 acres under cultivation, from which they have obtained 20 tons of fibre, and, possibly 200 tons will be the result of the 1906 crop. Two hundred and twenty tons is not a large return from such an area. The expenditure on over 3,000 acres must have been very considerable during six years. With cheap and abundant and reliable labour, the necessary humid climate, and abundant water supply, and cheap water carriage, one would have expected far greater results. Ribbons are worth £14 per ton in the English market. Clean, de-gummed fibre is worth £50 per ton. Clean, undegummed fibre from the plantation is worth about £24 per ton in London. At this latter price, 220 tons would be worth £5,280, or a return of £880 per annum spread over the six years since commencement. Decorticating machines, motive power, expenses of management, labour, freights, &c., have all to be deducted.

"Mr. J. Macdonald (of Macdonald, Boyle & Co., London) estimated the cost of 900 acres of Ramie under cultivation from planting to extraction of the fibre at £6,477 17*s.*, and the machinery at £6,775.

"At the end of the first year the product might be estimated at 450 tons of clean fibre, ready for the manufacturer. This, at 4½*d.* per lb., amounts to £18,900. Deducting the cost of production as above, also £900 for freight, and £260 for brokerage and incidentals, a working profit remains of £11,262 3*s.*

"This estimate, so extremely sanguine, was based on a three and a half to four years old Ramie plantation. Yet Mr. Macdonald begins operations six months after planting! An obvious discrepancy. Practical men would be better pleased to see a well-considered moderate statement work out a possible profit of £5 per acre than to be met with £12 profit per acre the first year, and well nigh £50 in the second, from a cultivation which, so far as we know, no one has yet tried, except the Bengal syndicate above described, on a scale sufficiently large to justify reliable estimates for a plantation, at any rate in the Eastern world.

"Queensland planters would not be likely to drop sugar, cotton, pineapples, &c., for a return of £880 per annum from 1,950 acres, and from which return heavy expenses have to be deducted."

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M. S. del. et lith.

Codonopsis Tangshen, Oliv.

IV.—T'ANG-SHÊN.

(*Codonopsis Tangshen*, Oliv.)

(With Plate.)

E. H. Wilson.

The source of the bulk of the drug *T'ang-shên*, an important Chinese drug, accredited with tonic and aphrodisiac properties and largely used as a substitute for the valuable and costly Ginseng, is the species described by Professor Oliver as *Codonopsis Tangshen* in *Hooker's Icones Plantarum*, t. 1966. A copy of the figure there given, for which Kew is indebted to the kindness of the Bentham Trustees, accompanies this note. The species has since been figured, from a living example, in the *Botanical Magazine*, t. 8090.

The part used is the thickened root, which varies from the thickness of a lead pencil to nearly an inch in diameter. When broken these roots emit a milky sticky juice, and the whole of the root when bruised has a curious and not very pleasant odour.

Codonopsis Tangshen is common in the margins of thickets above 4,000 feet in Hupeh, Szechuan, and apparently also in Shensi. These wild plants are searched for by medicine-gatherers, the roots dug up, dried in the sun or artificially, tied up in various ways and imported to all parts of China. Hankow is the principal port of export for this drug and on an average some 8,500 piculs (about 500 tons) are exported annually.

The drug has many trade names, according to its source and the manner in which it is packed. Thus, T'ang-shên from—

Szechuan is distinguished as Ch'uan-t'ang ;
Hupeh (Fang district) is distinguished as Fang-t'ang ;
Shense (Fang district) is distinguished as Hsi-t'ang.

Fêng-p'i (Fêng-p'i t'ang, Hung-t'ang) is the name applied when the drug is fastened into bundles with red cord. Hsiang-t'ang is the drug selected and packed in boxes. Pao-t'ang is the name applied when the drug is packed in bales. The different grades are valued at from taels 3.00 to taels 15.00 per picul.

An inferior kind is furnished by *Codonopsis lanceolata*, Benth. and Hook. fil., which grows associated with *C. Tangshen*.

From the province of Shansi is exported a different kind of T'ang-shên distinguished as Lu-t'ang (meaning T'ang-shên from the Lu-an prefecture in Shansi). This Lu-t'ang is probably furnished by *Campanumoea pilosula*, Franch., a plant first discovered by Pére David in the neighbourhood of Peking.

It is probable that other species of *Campanumoea* and *Codonopsis* yield a kind of T'ang-shên in different parts of China.

The Chinese drug Ming-t'ang-shên is supposed to possess similar properties to the true T'ang-shên, and is exported in fairly large quantities from the province of Anhwei, through the port of Wuhu, and in small quantities from the Kiangsu province by way of Chiukiang. The source of this drug is not actually known, but there is reason to believe it to be the product of *Adenophora polymorpha*, Ledeb.

V.—THE SYNONYMY AND DISTRIBUTION OF THE SPECIES OF TRICUSPIDARIA.

T. A. Sprague.

Introduction.

The genus *Tricuspidaria* belongs to the family *Elaeocarpaceae*, and is endemic in Chili; the area inhabited by it is almost that of Drude's "Chilian Wood Region" (Atlas der Pflanzenverbreitung, No. vii., Region 28), except that *Tricuspidaria* apparently does not extend farther south than the island of Chiloe. If we follow Ball (in Journ. Linn. Soc. Bot., vol. xxii., p. 140), however, in taking the parallel of 44° S. as the boundary between the "Chilian Wood Region" and the "Antarctic Wood Region" (Drude, l.c., Region 29), then the area occupied by *Tricuspidaria* practically coincides with the former region. In connection with their distribution it is interesting to note that both species of *Tricuspidaria* have the capsule provided with a drip-tip, *see* Neger in Engl. Bot. Jahrb., vol. xxiii., p. 378.

The closest relationship of *Tricuspidaria* is undoubtedly with *Dubouzetia*, Panch., which is endemic in New Caledonia. *Dubouzetia* was founded on *D. campanulata*, Panch., and was originally distinguished from *Tricuspidaria* by the following characters:—petals entire; stamens more numerous (about 35); fruit septicidal (Brongn. et Gris, in Bull. Soc. Bot. France, vol. viii. [1861], p. 199). The number of cells of the ovary and capsule was given in the generic description as 5, and that of the ovules in each cell as 10–12. Two years later, however, Brongniart and Gris described two new species, *D. elegans* and *D. parviflora*, which had about 25 stamens, a 3–4- or 3–5-celled ovary and capsule, and 6 ovules in each cell, approaching more nearly to *Tricuspidaria* in these respects (l.c., vol. x., p. 476). In 1868 Brongniart and Gris published a further paper in which (Nouv. Arch., Mus. Par., vol. iv., p. 34, t. 13) they gave a fuller description and an excellent figure of *D. campanulata*, from which it appears that the capsule of that species is *simultaneously* septicidal and imperfectly loculicidal. [The capsule of *D. elegans*, on the other hand, is *loculicidal* with only a very faint indication of a septicidal split or none at all, so that the distinction drawn between *Dubouzetia* and *Tricuspidaria*, as regards the dehiscence of the fruit, now breaks down. *See Vieillard*, No. 50, in the Kew Herbarium.]

Bocquillon had already stated in his "Mémoire sur le groupe des Tiliacées" (Adansonia, vol. vii., p. 55, Sept. 1866) that the only difference between *Tricuspidaria* and *Dubouzetia* lay in the dehiscence of the fruit; and Baillon in 1873 (Hist. Pl., vol. iv., p. 198) united the two genera, adopting the generic name *Crinodendron*, which is an earlier name for *Tricuspidaria*.*

In 1885, Szyszylowicz published his monograph of the Tiliaceae, in which he kept *Dubouzetia* and *Tricuspidaria* separate, partly on the ground of the different dehiscence of the capsule in the two genera (Engl. Bot. Jahrb., vol. vi., pp. 452–3). Other

* The reasons for the adoption of *Tricuspidaria* in preference to *Crinodendron* are given at p. 15.

diagnostic generic characters given by Szyszylowicz are that the 5 carpels (when all present) are opposite the sepals in *Tricuspidaria* and opposite the petals in *Dubouzetia* (l.c., p. 448); and that the seeds of *Tricuspidaria* have a wing-like strophiole, those of *Dubouzetia* a spiral strophiole (l.c., p. 450). Lack of material has prevented the verification of the two additional characters just mentioned. Szyszylowicz also used the union or non-union of the sepals to distinguish the two genera. He seems to have overlooked Brongniart and Gris's second paper (Bull. Soc. Bot. France, vol. x., p. 476), as he states in the generic description of *Dubouzetia* that the ovary is 5-celled (Engl. Bot. Jahrb., vol. vi., p. 453).

Schumann in 1890 practically followed Szyszylowicz (Engl. und Prantl, Pflanzenfam., vol. iii., pars vi., p. 6), as did also Dalle Torre and Harms in 1901 (Gen. Siphonog., p. 304); the latter attribute only one species to *Dubouzetia*.

It may be useful to give the more certain external characters which separate *Tricuspidaria* and *Dubouzetia*, although it appears doubtful whether they are of generic value.

Tricuspidaria.—Sepals more or less united; petals trifid; stamens 15–20.

Dubouzetia.—Sepals free; petals entire; stamens 25–35.

The following account of the anatomy of *Tricuspidaria* and *Dubouzetia* has been furnished by Mr. L. A. Boodle, F.L.S. Owing to pressure of work, only one species of each genus could be examined.

"A comparison of the anatomical structure of *Tricuspidaria lanceolata*, Miq., with that of *Dubouzetia campanulata*, Panch, shows a rather close agreement in the more important characters, as well as in a certain number of minor details.

"The two species agree in the following features. In the leaf: the hairs are uni-cellular, and of similar form; large crystals of oxalate of lime are present in enlarged cells of the palisade-tissue; some of the smaller veins are accompanied by sclerenchyma, and are connected with the upper and lower epidermis by sclerenchymatous or slightly thickened cells; in the midrib there is a somewhat broken ring of fibro-vascular tissue, having practically the same form and structure in the two cases. In the stem: the cork cells are tabular; sclerotic cells are present in the inner part of the primary cortex; there is a ring composed of fibres and sclerotic cells in the pericycle; the phloem includes bast-fibres (few), and vertical rows of cells containing crystals; the wood-fibres have simple pits; the medullary rays of the wood are one cell in breadth; the vessels have simple perforations, and sometimes form radial rows; the portions of the vessel-wall in contact with medullary ray-tissue bear large simple pits; the cells of the pith are lignified and of different sizes, and some of them contain crystals.

"In describing the points of difference between the two species, "T." will stand for *Tricuspidaria lanceolata*, "D." for *Dubouzetia campanulata*. Walls of upper epidermis undulated (T.); straight (D.). Spongy parenchyma denser, and with less chloro-

phyll in T. In the lower epidermis each cell bears a papilla (T.); only a few slight papillae present (D.). Stomata in the plane of the epidermis (T.); stomata raised (D.). The structure of the upper part of the petiole is not very different in the two species, but there is a considerable difference in the basal region. In the stem the pitted vessels of the wood have spiral thickenings (T.); no spiral thickening (D.).

"All the points of difference enumerated above are comparatively unimportant, and are such as are often found within the limits of a single genus. Hence the investigation of the anatomy confirms the close relationship of *Tricuspidaria* and *Dubouzetia*, while leaving undecided the question as to whether the two genera should be united or kept separate."

Whether we regard *Tricuspidaria* and *Dubouzetia* as congeneric or as two closely allied genera, their distribution is equally interesting, for it is evident that they form a well-defined group with a distribution of the kind termed by Engler "old-oceanic" (Versuch einer Entwicklungsgeschichte der Pflanzenwelt, vol. ii. pp. 262, 329, 346). A list of genera and groups of allied genera, with a somewhat similar distribution, is given by Engler in the course of his remarks on the Flora of New Zealand (l.c., pp. 95–103). In what follows, the name *Tricuspidaria* is here used in the narrow sense, as including only the Chilian species.

The Species of Tricuspidaria.

Although only two species of *Tricuspidaria* are known, their synonymy has become somewhat involved, and it is therefore thought desirable to give it in full. The two species may be distinguished as follows:—

1. *T. lanceolata*, Miq. Folia lanceolata vel oblongo-lanceolata, apice acuta. Calyx jam in alabastro fere ad basin 2–4-partitus, extra pubescens. Corolla rubra. Ovarium tomentosum.
2. *T. dependens*, Ruiz et Pav. Folia obovata, elliptica vel ovata, apice rotundata vel obtusa. Calyx in alabastro cupularis, extra minutissime puberulus. Corolla alba. Ovarium minute puberulum.

1. **Tricuspidaria lanceolata**, Miq., in Linnaea, vol. xxv. (1852), p. 650; W. Wats. in Gard. Chron. Ser. III. vol. xxxviii. (1905), p. 306, excl. syn. *T. Patagua*, Miers.

? *Crinodendron Patagua*, Molina, Saggio Chili (1782), p. 179, *ex parte*; Hist. Chil. ed. angl. vol. i. pp. 146, 290, *ex parte*; Cav. Diss., pp. 268, 300, *ex parte*, t. 158, fig. A.

Crinodendron Patagua, Hook. et Arn. in Hook. Bot. Misc. vol. iii. (1833), p. 156, t. 100; Kuntze, Rev. Gen. (1891), p. 82.

Crinodendron Hookerianum, C. Gay, Fl. Chil. vol. i. (1845), p. 341; Miers in Ann. & Mag. Nat. Hist. Ser. IV. vol. ii. (1868), p. 53; Contrib. Bot. vol. ii. p. 189, t. 83A; F. Philippi, Cat. Pl. Vasc. Chil. p. 31; F. W. Neger in Verh. deutsch. wiss. Ver. Santiago, vol. iii. (1895), pp. 149–153; Reiche, Fl. Chile, vol. i.

p. 266 (1896); Jeogr. Bot. Rio Manso, pp. 125–154 (Ann. Univ. Chile, 1898); The Garden, vol. xviii. p. 542, t. 260 (Nov. 27, 1880).

Tricuspidaria hexapetala, Turcz. in Bull. Soc. Nat. Mosc. vol. xxxvi. (1863), pars i. p. 576; Nichols. Dict. Gard. vol. iv. p. 87, fig. 99.

Tricuspidaria dependens, Hook. f., Bot. Mag. t. 7160 (excl. synon. nonnull.); J. H. Veitch, Hortus Veitchii, pp. 58, 293; non Ruiz et Pav.

Tricuspidaria Hookeriana, R. O. Cunningham, Nat. Hist. Strait Magell. (1871), pp. 342, 433.

A small evergreen tree, attaining a height of 3–5 m.* Confined to the provinces of Valdivia and Llanquihue, and the island of Chiloe, where it is found in moist, wooded, low-lying situations. The range of the species is approximately from 39° to 43° S. lat. It is known by the following native names :—*Chequehue*, *Chaqueihua*, and *Polisones*.

According to F. W. Neger (l.c.), a gall named *Erineum Crinodendri* is produced by *Phytoptus* on the leaves of *T. lanceolata*; and nearly every specimen of *T. lanceolata* in the Kew Herbarium has what appears to be the gall in question on the under surface of its leaves.

Valdivia. *Philippi:* near Corral, *Bridges*, 613; between Corral and San Carlos, *Lechler*, 269.

Llanquihue. Region of the Rio Manso, in woods of the littoral zone (ex Reiche, teste Just. Bot. Jahresb. vol. xxvi. pars i. p. 566).

Chiloe. *Lobb; Reed; King: Cuming*, 22; Gulf of Ancud, Oscuro Cove, *Cunningham*.

2. **Tricuspidaria dependens**, Ruiz et Pav. Prodr. (1794), p. 64, t. 36; Syst. p. 112; Fl. Peruv. et Chil. vol. iv. t. 403; DC. Prodr. vol. i. p. 520; A. Cruckshanks, in Hook. Bot. Misc. vol. ii. (1831), p. 172; Hook. et Arn. in Hook. Bot. Misc. vol. iii. (1833), p. 155; C. Gay, Fl. Chil. vol. i. p. 338; Miers in Ann. & Mag. Nat. Hist. Ser. IV. vol. ii. (1868), p. 50; Contrib. Bot. vol. ii. p. 186; F. Philippi, Cat. Pl. Vasc. Chil. p. 31; N. L. Britton in Bull. Torr. Bot. Club, vol. xvi. (1889), p. 157; Neger in Engl. Bot. Jahrb. vol. xxiii. p. 378 (1896); Introd. Fl. Concepcion, p. 40 (Ann. Univ. Chile, 1897); W. Wats. in Gard. Chron. Ser. III. vol. xxxviii. (1905), p. 306; Sprague in Bot. Mag. t. 8115.

Tricuspis dependens, Pers. Syn. vol. ii. (1807), p. 9.

Tricuspidaria Patagua, Miers, in Ann. & Mag. Nat. Hist. Ser. IV. vol. ii. (1868), p. 51, excl. syn. *Crinodendron Patagua*, Mol.; Contrib. Bot. vol. ii., p. 187, t. 82.

Crinodendron Patagua, K. Schum. in Engl. und Prantl., Pflanzenfam. vol. iii., pars. vi., p. 6, t. 1, fig. C–E (1890); Reiche, Fl. Chile, vol. i., p. 266; non Molina nec Cav.

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* The ‘ height of 30 ft.,” given in Gard. Chron. Oct. 1905, p. 306, for *T. lanceolata*, Miq., is copied from Miers's description of *T. Patagua*, Miers, and refers properly to *T. dependens*, Ruiz et Pav.

Crinodendron dependens, Kuntze, Rev. Gen. (1891), p. 82.

An evergreen tree, attaining a height of 6–8 m. Confined to the central provinces of Chili, where it is found on the banks of streams and in other moist situations. It ascends to 1200 m. in the Cordilleras. A specimen in the Benthamian herbarium is marked "Aconcagua Ld. Colchester, 1832," which is the most northern locality recorded; and, according to Reiche, the species is found as far south as Lebu; so that its range is approximately from 32° to 38° S. lat.

According to C. Gay, the wood is very white, and is much used for carpentry and even for cabinet-making, and the bark is employed in tanning; Gay also states that silkworms eat the leaves of *T. dependens* with relish, but that the Mulberry should always be cultivated in preference for that purpose. The native name is *Patagua*.

Nearly every specimen of *T. dependens* in the Kew Herbarium has fairly numerous subglobose galls on the under surface of its leaves, of very different appearance to the *Erineum Crinodendri* found on *T. lanceolata*. Each kind of gall appears to occur on only one species of *Tricuspidaria*, and the galls are of such frequent occurrence that they might almost be taken as additional specific characters separating *T. dependens* and *T. lanceolata*.

ACONCAGUA (dedit *Lord Colchester*, 1832).

VALPARAISO. *Cuming*, 85; *Philippi*; *King*; *Rusby*, 1025 (ex Britton).

SANTIAGO. Near La Dormida, in the Quebrada de Alvarado, *Gillies*.

O'HIGGINS. Aculeo, *Reed*.

CONCEPCION. *Dombey* (ex Miers); in the neighbourhood of the town of Concepcion (ex Neger).

ARAUCO. Lebu (ex Reiche).

CHILI (without precise locality). *Cruckshanks*, 114; *Bridges*, 159.

There is also a specimen of *T. dependens* in the Hookerian herbarium, marked "Bolivia, Mr. Pentland," but the locality given is more than doubtful.

For suggestions as to the most satisfactory treatment of both species under cultivation in this country, reference may be made to the article on the genus by Watson, published in the *Gardeners' Chronicle* in 1905, cited above. This article possesses the further interest of giving the most satisfactory account of their synonymy which has hitherto appeared.

DISCUSSION OF THE SYNONYMY.

It now remains to consider the identity of *Crinodendron Patagua*, Molina, Saggio Chili (1782), p. 179; Hist. Chil. ed. angl., vol. i., pp. 146, 290; Cav. Diss., pp. 268, 300, t. 158, fig. A—E. Cavanilles states that the figure and description of *C. Patagua* were communicated to him by Molina, so that Cavanilles's description and that of Molina may be considered together.

In the first place it is evident that both descriptions contain characters of at least two very different plants. Cav. Diss., t. 158, fig. A, is *apparently* a bad figure of the species figured by Hooker and Arnott in 1833 under the same name, *Crinodendron Patagua*, and redescribed by Miquel in 1852 under the name *Tricuspidaria lanceolata*. Hooker and Arnott have been followed by Kuntze (1891) in their identification of fig. A.

C. Gay, on the other hand, followed by K. Schumann (1890) and Reiche (1896), identified Cavanilles's figure with *Tricuspidaria dependens*, Ruiz et Pav., and gave to *Crinodendron Patagua* Hook. et Arn., the new name *Crinodendron Hookerianum*. Unfortunately, Gay did not state on what grounds he based his reversal of Hooker and Arnott's identification; whether, in fact, he had seen type specimens of Molina or Cavanilles, or not.

Comparison of fig. A, and of the descriptions given by Molina and Cavanilles, with *T. dependens* and *T. lanceolata*, yields the following points in favour of the identity of *Crinodendron Patagua*, Molina, with *T. lanceolata*:—1, leaves lanceolate, acute; 2, flowers and flower-buds more nearly the shape and size of those in *T. lanceolata*; 3, petals shown as apparently entire [in *T. lanceolata* the petals are much less obviously trifid than in *T. dependens*].

The only point in favour of *C. Patagua*, Molina, being conspecific with *T. dependens*, Ruiz et Pav., is the native name, viz., *Patagua**, which is the same in both.

Both Molina and Cavanilles describe the stamens of *Crinodendron Patagua* as 10 in number, and monadelphous, and this part of their descriptions together with the great diameter of the trunk (7 ft.) point to a tree of another family having been confused with *T. lanceolata* by Molina. Fig. B of Cavanilles shows the 10 monadelphous stamens, and is, therefore, also to be excluded. Figs. C, D, E may conceivably have been drawn from a fruit of *Tricuspidaria*, but if so the reproduction is wretchedly inaccurate.

In conclusion, it may be well to give our reasons for adopting the name *Tricuspidaria* instead of *Crinodendron*, and the combination *T. lanceolata* in preference to any of its synonyms.

1. The genus *Crinodendron*, Molina, was based (in 1782) on a *mixture* of at least two species, belonging to different families.

2. It remained of doubtful position until re-described in 1833 and referred to the *Elaeocarpeae* by Hooker and Arnott. In the meantime it was placed among *Plantae incertae sedis* in Juss. Gen. Pl. (1789), p. 431; retained in *Monadelphia Decandria*, in Gmel. Syst. (1791), p. 1026, and Spreng. Syst. vol. iii. (1826), p. 78; transferred to *Linozosteae*, in Spreng. Anleitung, p. 889 (1818); to *Euphorbiaceae*, in Agardh Aphor., p. 195 (1823); and doubtfully placed in *Samydeae*, in Reichb. Consp. (1828), p. 177.

Tricuspidaria, on the other hand, was accurately described and figured in 1794, and placed in *Dodecandria Monogynia*; more

* According to Gay, Fl. Chil., vol. ii., p. 393, the name *Patagua* is also applied (in Valdivia) to *Eugenia planipes*, Hook. et Arn.

fully figured in 1802; placed in *Tiliaceae* by St. Hilaire in 1805 (Expos., vol. ii., p. 94, ex Pfeiffer); and transferred to *Elaeocarpeae* in 1824 (DC. Prodr., vol. i., p. 520).

3. The species *Crinodendron Patagua*, Molina, cannot now be identified with *certainty*.

The specific name *lanceolata* is the earliest (in the species under consideration) about which there is *no ambiguity*. The adoption of the specific name *Patagua* would imply the identity of the doubtful *C. Patagua*, Mol., with *T. lanceolata*, Miq., and this cannot be proved; it is also undesirable on account of the pre-existing *T. Patagua*, Miers, now reduced to *T. dependens*, Ruiz et Pav. The adoption of the name *Hookeriana* is also open to objection, since it implies that Gay was right in identifying *C. Patagua*, Mol., with *T. dependens*, Ruiz et Pav. The two remaining specific names available are *lanceolata* and *hexapetala*; the former is the earlier and is more diagnostic.

VI.—REDUCTIONS OF THE WALLICHIAN HERBARIUM.—I. BIGNONIACEAE; PEDALINEAE.

C. B. Clarke.

The Wallichian Herbarium was the Herbarium belonging to the Honourable East India Company. Its contents were distributed under the Company's orders in 1828 and subsequent years by Dr. N. Wallich, F.R.S., with the assistance of various other botanists. The type set was presented by the Company to the Linnean Society of London, at whose premises it is now preserved. At various times the late Mr. C. B. Clarke and others have had occasion to critically examine portions of this type set, and Mr. Clarke has left in manuscript the reductions resulting from his examination of the specimens.

These reductions are likely to be of practical utility to those in charge of the various distributed sets of the Herbarium, and in order that they be more readily available it is proposed to publish them in the *Kew Bulletin*.

Bignoniaceae.

487. *Incarvillea Emodi*, Wall. (1 sheet), left-hand example = Amphicome arguta, Lindl.; right-hand examples = Amphicome Emodi, Lindl.

6498. *Bignonia undulata*, Roxb. (2 sheets) = Tecoma undulata, G. Don.

6499. *Bignonia suaveolens*, Roxb. (8 sheets) = Stereospermum suaveolens, DC.

6500. *Bignonia fimbriata*, Wall. (1 sheet) = Stereospermum fimbriatum, DC.

6501. *Bignonia chelonoides*, Roxb. (7 sheets), A (two), B, C, D, E = STEREOSPERMUM CHELONOIDES, DC. 6501 F = *Stereospermum chelonoides*, DC. ? ; *Oroxylum indicum*, Vent. ?

6502. *Bignonia adenophylla*, Wall. (4 sheets), A, A β, B = HETEROPHRAGMA ADENOPHYLLUM, Seem. 6502 α γ, Leaf and bud = HETEROPHRAGMA ADENOPHYLLUM, Seem. ; capsule = STEREOSPERMUM SUAVEOLENS, DC.

6503. *Bignonia multijuga*, Wall. (2 sheets) = PAJANELIA RHEEDII, DC.

6504. *Bignonia macrostachya*, Wall. (1 sheet) = ? The example consists of flowers only. According to G. Don, Gen. Syst. iv. 221, the leaves are 1-pinnate, with 9 stipelled leaflets.

6505. *Bignonia laeta*, Wall. (2 sheets), A = STEREOSPERMUM SERRULATUM, Kurz ; B (leaves only) = ? (perhaps not Bignoniaceous).

6506. *Bignonia glauca*, Wall. (1 sheet) = ? Example consists of leaves only ; perhaps not Bignoniaceous.

6507. *Bignonia quadriloculari*s, Ham. (1 sheet) = HETEROPHRAGMA ROXBURGHII, DC. ? The example consists of one leaf only.

6508. *Bignonia grandiflora*, Thunb. (1 sheet) = TECOMA GRANDIFLORA, Loisel.

6509. *Bignonia Porteriana*, Wall. (1 sheet) = STEREOSPERMUM GLANDULOSUM, Miq.

6510. *Bignonia Ghorta*, Ham. (1 sheet) = STEREOSPERMUM ? GHORTA, C. B. Clarke.

6511. *Bignonia xylocarpa*, Roxb. (4 sheets) = STEREOSPERMUM XYLOCARPUM, Wight.

6512. *Bignonia amoena*, Wall. (1 sheet) = STEREOSPERMUM HYPOSTICTUM, Miq.

6513. *Bignonia suberosa*, Roxb. (4 sheets) = MILLINGTONIA HORTENSIS, Linn. f.

6514. *Bignonia indica*, Linn. (4 sheets), A, D = OROXYLUM INDICUM, Vent. ; B (at least the flowers) = PAJANELIA RHEEDII, DC. ; C = ? C is a leaf only, neither *Oroxylum* nor *Pajanelia*.

6515. *Spathodea crispa*, Wall. (2 sheets), A = DOLICHANDRONE CRISPA, Seem. ? ; B = DOLICHANDRONE CRISPA, Seem. The example A is from the Calcutta Botanic Garden, and has the corymbs and mature leaves hairy.

6516. *Spathodea Rheedii*, Spreng. (1 sheet) = DOLICHANDRONE RHEEDII, Seem.

6517. *Spathodea falcata*, Wall. (2 sheets) = DOLICHANDRONE FALCATA, Seem.

6518. *Spathodea stipulata*, Wall. (4 sheets), A, part C, D = DOLICHANDRONE STIPULATA, Benth.; B, part C = STEREOSPERMUM? WALLICHII, C. B. Clarke. (D. Don has noted on 6518 B, in his own hand, *Spathodea Wallichii*, D. Don; and Seemann has made a note on the same sheet, but has made no suggestion as to the genus.)

PEDALINEAE.

6408. *Sesamum indicum*, Linn. (7 sheets), is good.

6409. *Sesamum prostratum*, Retz. (2 sheets), is good.

6410. *Pedalium Murex*, Linn. (1 sheet), is good.

VII.—MISCELLANEOUS NOTES.

Visitors during 1906.—The number of persons who visited the Royal Botanic Gardens during the year 1906 was 2,339,492. This establishes a record, the previous highest number in any one year having been 1,839,966 in 1890. The number for 1905 was 1,824,319. The average for the ten years 1896–1905 was 1,376,244. The total number on Sundays was 867,148, and on week-days 1,472,344. The maximum number on any one day was 113,131, on August 6, also a record number for a single day; the smallest number on any one day was 204, on February 17.

The detailed monthly returns are given below :—

January	27,736
February	33,407
March	66,613
April	267,629
May	159,071
June	513,095
July	372,398
August	425,117
September	277,917
October	137,201
November	34,042
December	25,266

MR. T. W. BROWN, formerly a member of the gardening staff of the Royal Botanic Gardens, Kew, and for some time Assistant Curator of the Botanic Station, Aburi, Gold Coast (*K.B.*, 1899, 50, 221), has been appointed Secretary of the newly formed Horticultural Society at Ghizeh near Cairo.

ANGELA GEORGINA, Baroness BURDETT-COUTTS.—The death of Lady Burdett-Coutts, on 29th December, 1906, leaves no part of the community and few institutions of public utility unaffected.

Kew, in common with many another establishment, mourns the loss of one whose interest in its objects and work took the practical form of timely gifts.

In 1862 Lady Burdett-Coutts presented to Kew the large collection of British seaweeds formed by the late Mrs. Griffiths of Torquay, as it stood at that date. During her lifetime this lady was one of the leading authorities on seaweeds in England. She corresponded extensively with and contributed largely to the herbaria of Sir W. Hooker, Dr. Harvey, Mr. W. Borrer and other contemporary algologists. But besides her presentations to fellow-workers Mrs. Griffiths disposed during her life-time of one collection of Algae to the British Museum, and presented another to the Torquay Museum. On Mrs. Griffiths' death, which occurred in 1857, a complete set of her collection of seaweeds was acquired for the Linnean Society, in whose possession it now is. The general collection from which this set had been taken was purchased by Lady Burdett-Coutts and given by her to Kew. The collection was kept apart till 1891 when it was decided to incorporate as much of it as was desirable in the general collection, which already contained the extensive set of specimens given by Mrs. Griffiths during her life-time to Sir William Hooker. Very many of these earlier specimens were removed from the general collection and replaced by better specimens from the special collection, all of which, with the exception of such specimens as had been presented to her by other collectors, have the localities and names entered in Mrs. Griffiths' own handwriting. The extent and value of Lady Burdett-Coutts' gift may best be gathered from the fact that when Mrs. Griffiths' collection was incorporated in the general herbarium, six sets of duplicates were made up at Kew and presented to six other botanical establishments.

In 1880 Kew was indebted to Lady Burdett-Coutts for another and still more important gift. In that year she purchased and presented to Kew the herbarium of the late Dr. W. P. Schimper, Professor of Botany in the University of Strassburg, author, in conjunction with Bruch and Gümbal, of the *Bryologia Europaea*, a work in six quarto volumes, with 640 plates, giving a critical account of the mosses of Europe. In recording this gift the *Kew Report* (in 1880, p. 63), says :—" Dr. Schimper's herbarium, upon which " the *Bryologia* was in the main founded, contains a profusion of " specimens of *Musci* collected with unrivalled judgment and " preserved and ticketed with scrupulous care. It further contains " the muscological collections of Bruch and other of the older " botanists, who published on the group, together with a mis- " cellany of interesting plants (especially *Hepaticae*) from various " sources."

In addition, it may be added, the herbarium contains the types corresponding to Schimper's monograph of the genus *Sphagnum*, and a number of manuscript descriptions and exquisite drawings of a large number of species of mosses not included in the *Bryologia*.

Plants suitable for the Warmer Parts of the United Kingdom.—Enquiries are frequently made at Kew by those interested in horticulture as to the hardiness of particular species, the merits of which have been casually brought to their notice. To meet the needs and extend the knowledge of correspondents, it seems therefore advisable to draw up a compact list of such plants as are known to be too tender to survive permanently out-of-doors in the British Islands except in the milder localities, such as Cornwall, South Wales, Western Ireland, and the West of Scotland. The list, which is given below, makes no pretence at being exhaustive. The species it includes are, however, all known to be in cultivation out-of-doors at present in one or other of the localities indicated; the hardiness of all of them, under the climatic conditions that have prevailed during the winter and spring months of recent years, has thus been tested. It does not follow that all of these species will prove permanently hardy in any of the localities, or that any of them will, even under normal conditions, thrive equally well in all of the localities mentioned. But, subject to the limitations which those who find occasion to consult it are competent to apply, the list may prove useful to those who are engaged in forming out-of-doors collections in the milder parts of the kingdom.

Abelia floribunda, *Decne*, Mexico.
„ uniflora, *R. Br.*, China and Japan.
Abutilon megapotamicum, *St. Hil.*, Brazil.
„ vitifolium, *Presl*, Chili.
Acacia armata, *R. Br.*, Australia.
„ Baileyana, *F. Muell.*, Australia.
„ cultriformis, *A. Cunn.*, Australia.
„ dealbata, *Link*, Australia.
„ decurrens, *Willd.*, Australia.
„ hastulata, *Sm.*, Australia.
„ juniperina, *Willd.*, Australia.
„ longifolia, *Willd.*, Australia.
„ platyptera, *Lindl.*, Australia.
Acradenia Frankliniae, *Kipp.*, Tasmania.
Actinidia callosa, *Lindl.*, Temperate Asia.
Anopterus glandulosus, *Labill.*, Tasmania.
Aristotelia Macqui, *L'Hérit.*, Chili.
„ racemosa, *Hook. f.*, New Zealand.
Azara Gilliesii, *Hook. & Arn.*, Chili.
Bauhinia yunnanensis, *Franch.*, China.
Begonia Evansiana, *Andr.*, China, &c.
„ Hemsleyana, *Hook. f.*, Yunnan.
Berberidopsis corallina, *Hook. f.*, Chili.
Berberis Fortunei, *Lindl.*, China.
„ Fremonti, *Torr.*, South-west United States.
Boronia elatior, *Bartl.*, Australia.
Brachyglottis repanda, *Forst.*, New Zealand.
Buddleia asiatica, *Lour.*, Malaya, &c.
„ Colvilei, *Hook. f.*, Himalaya.
Caesalpinia sepiaria, *Roxb.*, Tropical Asia.
Calceolaria alba, *Ruiz & Pav.*, Chili.
„ amplexicaulis, *H. B. & K.*, Ecuador.
„ violacea, *Cav.*, Chili.
Callistemon lanceolatus, *DC.*, Australia.
„ phoeniceus, *Lindl.*, Australia.
„ salignus, *DC.*, Australia.
Camellia reticulata, *Lindl.*, China.
„ theifera, *Griff.*, China.
Carpentaria californica, *Torr.*, California.
Caryopteris Mastacanthus, *Schau.*, China.
Cassia corymbosa, *Lam.*, Tropical America.
„ laevigata, *Willd.*, Tropics.
„ marylandica, *L.*, East United States.
Cavendishia acuminata. *Benth.*, Mexico.
Ceanothus divaricatus, *Nutt.*, California.
„ integerrimus, *Hook. & Arn.*, California.
„ papillosus, *Torr. & Gray*, California.
„ rigidus, *Nutt.*, California.
„ thyrsiflorus, *Eschsch.*, California.
„ Veitchianus, *Hook.*, California.
Cereus viridiflorus, *Engelm.*, Texas.
Cheiranthus kewensis, Garden origin.
„ mutabilis, *L'Hérit.*, Canaries.
Clematis indivisa, *Willd.*, New Zealand.
Clerodendron foetidum, *Bunge*, China.
Clianthus puniceus, *Banks & Sol.*, New Zealand.
Convolvulus cneorum, *L.*, South Europe.

Coriaria terminalis, *Hemsl.*, China.
Corokia Cotoneaster, *Raoul*, New Zealand.
Coronilla glauca, *L.*, South Europe.
„ valentina, *L.*, South-west Europe.
Correa, various species.
Corylopsis pauciflora, *Sieb. & Zucc.*, Japan.
Cotoneaster augustifolia, *Franch.*, Yunnan.
Crossosoma californicum, *Nutt.*, California.
Cyrilla racemiflora, *L.*, South United States.
Cytisus fragrans, *Lam.*, Canaries.
„ proliferus, *L.*, Teneriffe.
Davidia involucrata, *Baill.*, Western China.
Desfontainia spinosa, *Ruiz & Pav.*, Peru.
Deutzia corymbosa, *R. Br.*, Himalaya.
„ discolor, *Hemsl.*, China.
„ gracilis, *Sieb. & Zucc.*, Japan.
„ scabra, *Sieb. & Zucc.*, China and Japan.
Dianthus arboreus, *L.*, Greece.
Diervilla Middendorfiana, *Carr.*, Siberia, &c.
Drimys aromatica, *F. Muell.*, Australia.
„ Winteri, *Forst.*, South America.
Eccremocarpus scaber, *Ruiz & Pav.*, Chili.
Echium callithrysum, *Webb*, Canaries.
„ Wildpretti, *Hook. f.*, Canaries.
Edgeworthia chrysantha, *Lindl.*, Himalaya.
Ehretia acuminata, *R. Br.*, Tropical Asia.
Elaeocarpus cyaneus, *Sims*, Australia.
Embothrium coccineum, *Forst.*, Chili.
Enkianthus campanulatus, *Nichols.*, Japan.
„ japonicus, *Hook. f.*, Japan.
„ quinqueflorus, *Lour.*, China.
Erica arborea, *L.*, Mediterranean and Caucasus.
„ australis, *L.*, Portugal, &c.
„ lusitanica, *Rudolph*, Spain and Portugal.
„ Veitchii, Garden origin.
Erythrina Crista-galli, *L.*, Brazil.
Escallonia floribunda, *H. B. & K.*, Colombia, &c.
„ macrantha, *Hook. & Arn.*, Chiloe.
„ montevidensis, *DC.*, Montevideo, &c.
„ Philippiana, *Masters*, Valdivia.
Eucalyptus, various species.
Eucryphia cordifolia, *Cav.*, Chili.
„ pinnatifolia, *Gay*, Chili.
Fabiana imbricata, *Ruiz & Pav.*, Peru.
Feijoa Sellowiana, *Berg.*, Brazil.
Fendlera rupicola, *A. Gray*, South-west United States.
Fothergilla Gardeni, *Murr.*, South-east United States.
Francoa ramosa, *D. Don*, Chili.
„ sonchifolia, *Cav.*, Chili.
Fremontia californica, *Torr.*, California.
Fuchsia excorticata, *L.*, New Zealand.
Gerbera Jamesoni, *Bolus*, South Africa.
Gordonia anomala, *Spreng.*, China.
„ Lasianthus, *L.*, South United States.
Grevillea alpina, *Lindl.*, Australia.
„ Hilliana, *F. Muell.*, Australia.
„ juniperina, *R. Br.*, Australia.
„ rosmarinifolia, *A. Cunn.*, Australia.
Halesia corymbosa, *Nichols.*, Japan.
Hardenbergia Comptoniana, *Benth.*, Australia.
Helichrysum antennarium, *F. Muell.*, Australia.
„ rosmarinifolium, *Less.*, Tasmania.
Hibiscus Moscheutos, *L.*, South United States.
Hoheria populnea, *A. Cunn.*, New Zealand.
Hydrangea hortensis, *Sm.*, varieties, China and Japan.
„ involucrata, *Sieb. & Zucc.*, Japan.
„ paniculata, *Sieb. & Zucc.*, Japan.
Hypericum chinense, *L.*, China and Japan.
„ empetrifolium, *Willd.*, Greece, &c.
„ Hookerianum, *Wight & Arn.*, Himalaya.
„ patulum, *Thunb.*, India, China, &c.
Illicium anisatum, *L.*, Japan.
„ floridanum, *Ellis*, South United States.
„ religiosum, *Sieb. & Zucc.*, Japan.
Incarvillea Delavayi, *Bur. & Franch.*, China.
Isoplexis canariensis, *Steud.*, Canaries.
Itea ilicifolia, *Oliver*, China.
Jasminum grandiflorum, *L.*, Malaya.
„ primulinum, *Hemsl.*, Yunnan.
Kitaibelia vitifolia, *Willd.*, South Europe.
Lathyrus pubescens, *Hook. & Arn.*, South America.
„ splendens, *Kellogg*, California.
Lavatera maritima, *Gouan*, var. bicolor.
Leonotis Leonurus, *R. Br.*, South Africa.
Leptospermum flavescens, *Sm.*, Australia.
„ laevigatum, *F. Muell.*, Australia.
„ scoparium, *Forst.*, Australia and New Zealand.
Linum arboreum, *L.*, Greece, &c.

Lonicera etrusca, *Santi*, var. superba, *C. H. Wright*, Mediterranean region.
„ Hildebrandiana, *Hemsl.*, Burma.
„ sempervirens, *L.*, North America.
Loropetalum chinense, *Oliv.*, China and India.
Magnolia Campbellii, *Hook. f. & Thoms.*, Eastern Himalaya.
„ compressa, *Maxim.*, Japan.
„ stellata, *Maxim.*, Japan.
„ Watsoni, *Hook. f.*, Japan.
Mandevilla suaveolens, *Lindl.*, Argentina.
Myrtus bullata, *Sol.*, New Zealand.
„ communis, *L.*, South Europe.
„ Luma, *Barn.*, Chili.
„ Ugni, *Mol.*, Chili.
Nandina domestica, *Thunb.*, China and Japan.
Neviusia alabamensis, *A. Gray*, Alabama.
Nerium Oleander, *L.*, varieties, Orient.
Nicotiana glauca, *R. Grah.*, Argentina.
Notospartium Carmichaeliae, *Hook. f.* New Zealand.
Olearia, all species.
Passiflora coerulea, *L.*, Brazil.
Paulownia imperialis, *Sieb. & Zucc.*, Japan.
Philadelphus mexicanus, *Schl.*, Mexico.
Phlomis fruticosa, *L.*, South Europe, &c.
Photinia serrulata, *Lindl.*, Japan, and China.
Pieris formosa, *D. Don*, India and China.
Piptanthus nepalensis, *Sweet*, Temperate Himalaya.
Pittosporum, various species.
Plagianthus Lyallii, *Hook. f.*, New Zealand.
Plumbago capensis, *Thunb.*, South Africa.
Polygala myrtifolia, *L.*, South Africa.
Prunus ilicifolia, *Walp.*, North-west America.
Psoralea pinnata, *L.*, South Africa.
Punica Granatum, *L.*, South Europe.
Ranunculus cortusaefolius, *Willd.*, Canaries.
Raphiolepis japonica, *Sieb. & Zucc.*, Japan.
Rhaphithamnus cyanocarpus, *Miers*, Chili.
Rhododendron, various species.
Romneya Coulteri, *Harv.*, California.
Rosa Banksiae, *Ait.*, China.
„ bracteata, *Wendl.*, China.
„ laevigata, *Michx*, China.
Salvia dichroa, *Lam.*, Mediterranean region.
„ Grahami, *Benth.*, Mexico.
Schizophragma hydrangioides, *Sieb. & Zucc.*, Japan.
Senecio compactus, *T. Kirk*, New Zealand.
„ laxifolius, *Buch.*, New Zealand.
„ rotundifolius, *Hook. f.*, New Zealand.
Solanum aviculare, *Forst.*, Australia and New Zealand.
„ crispum, *Ruiz & Par.*, Chili.
„ jasminoides, *Paxt.*, Brazil.
Sollya heterophylla, *Lindl.*, Australia.
Sophora secundiflora, *Lag.*, Mexico.
„ tetraptera, *Mill.*, New Zealand.
„ viciifolia, *Hance*, China.
Stuartia pentagyna, *L'Hérit.*, South United States.
„ Pseudo-camellia, *Maxim.*, Japan.
Styrax japonicum, *Sieb. & Zucc.*, Japan.
„ Obassia, *Sieb. & Zucc.*, Japan.
Trachelospermum jasminoides, *Lem.*, China.
Tricuspidaria dependens, *Ruiz & Par.*, Peru.
Trochodendron aralioides, *Sieb. & Zucc.*, Japan.
Viburnum Carlesii, *Hemsl.*, Corea.
„ odoratissimum, *Ker-Gawl.*, China.
„ rhytidophyllum, *Hemsl.*, Central China.

Podocarpus milanjiana, *Rendle*, var. arborescens, *Pritz.*—A quantity of fresh seeds of this conifer received at Kew from the Botanic Garden at Entebbe, Uganda, have been distributed to numerous botanic gardens and arboreta in this country and elsewhere where the tree is likely to succeed. The following particulars regarding *Podocarpus milanjiana*, from Mr. M. T. Dawe's Report on a botanical mission through the forest districts of Buddu and the Western and Nile Provinces of the Uganda Protectorate, 1906, are of interest :—"About a mile south of Dumu village, near the Mugawe stream, occurs a coniferous tree, which, for specific purposes, affords one of the most valuable timbers of

Uganda. It is *Podocarpus milanjiana*, var. *arborescens*. . . . It occurs practically on the Lake shore, a point of considerable importance respecting transport, and is distributed more or less throughout the forests down to the Kagera River, and is said by the Baseba to extend beyond the Anglo-German boundary. The tree does not exceed about 40 feet in height, but serviceable timber can be cut from it. Its insect-resisting qualities are well known to the natives. Instances have come to my notice where the poles have been taken inland a distance of nearly 15 miles for building purposes. A chief, whose father had died and left a house built six years ago, is said to have rebuilt it with the same poles that were as sound as ever, and this is unusual where white ants occur. The young poles are very largely used for building purposes, and the result is that forests in thickly populated districts, like Sango and Kanabulemu, do not contain many large trees. This *Podocarpus* is known to the natives at Dumu as 'Mukeke,' at Kanabulemu and Sango as 'Musenene,' and to the Baseba as 'Muyunjui.' It grows usually in swampy forests, and could only be obtained in quantity during the dry seasons."

Mr. Dawe found the type sparsely distributed above 8,000 feet on Ruwenzori Mountain, where it forms a tree 40 to 70 feet high; the variety *arborescens* he found in Buddu, at an altitude of 3,900 feet.

W. W.

Sudan Gum.—In the *Kew Bulletin* for 1906, No. 4, p. 109, in an article dealing with "Persian Gum" a passage was quoted from the *Pharmaceutical Journal*, March 29th, 1890, p. 793. The writer of the passage in question, citing as his authority Professor E. Sickenberger, stated that quantities of Persian gum "are sent "from Bushire, either to a small port on the west coast of the "Red Sea or to Jedda, in order that it may be substituted for "Kordofan gum. It is thence conveyed to Assouan and packed "in old Kordofan packages and sold as genuine gum. Owing to "its pale color and the absence of any suspicion that the gum "from Assouan could be other than good Gum Arabic, a consider-"able amount has been sold."

This passage has attracted the attention of the Central Economic Board of the Sudan Government, who have instructed their Secretary to explain that the statement in the *Pharmaceutical Journal* is based on a misapprehension as to an incident which occurred fifteen years ago. The letter of explanation, which is reproduced below, shows that a large consignment of Persian gum was, at least on one occasion, purchased by a dealer at Assouan under the belief that he was buying Sudan gum; thus far, therefore, the statement in the *Pharmaceutical Journal*, based on Professor Sickenberger's authority, is accurate. But from the explanation it would appear that, whatever the extent to which the practice described by Professor Sickenberger may formerly have prevailed, that practice no longer exists.

CENTRAL ECONOMIC BOARD; SUDAN GOVERNMENT

Khartoum, December 9, 1906.

SUDAN GUM.

I have the honour to inform you that the attention of the Central Economic Board has been drawn to the Article xix. "Persian Gum" in *Kew Bulletin* No. 4 of 1906, in which it is stated that Persian gum is substituted for Gum Arabic at Assouan and is fraudulently exported as gum from the Sudan. I am directed to request that you would kindly have a contradiction of this statement published as enquiries show that no such practice exists and that the above mentioned paragraph is based on a misapprehension of the true facts of the case. If the statement is allowed to pass without comment it is calculated to depreciate the value of Sudan gum.

Probably Professor Sickenberger, who is quoted as the authority in this instance, has been misinformed of an incident which occurred some fifteen years ago. At that time the Sudan had not been reconquered. Consequently supplies of gum were small and fetched very high prices. At about that date a Cairo merchant purchased in Assouan a large consignment of what he believed to be Sudan gum. It was in fact Persian gum which had probably been introduced into Assouan in the manner mentioned by Professor Sickenberger. The matter formed the subject of legal proceedings in Cairo in which the person who supplied me with this information acted as expert witness.

Sudan gum is now so cheap that substitution of the nature described would not be worth the expense.

Additions to the Herbarium during 1906.—Besides the Churchill Herbarium, the gift of which was recorded in *Kew Bulletin* for 1906, p. 387, over 22,000 sheets were presented by about one hundred and forty persons and institutions, while over 5,700 sheets were purchased. The principal collections are enumerated below. Except where otherwise stated or implied, the collections purchased are named, and those presented are unnamed or only partially named.

VARIOUS PARTS OF THE WORLD.—*Presented*:—named Characeae and marine Algae, by the New York Botanical Garden; Seymour and Earle, Economic Fungi, Suppl. C., Nos. 101–150, by Mr. G. P. Clinton; named Crassulaceae, by the United States National Museum; named Orchids, by the Department of Agriculture, Buitenzorg; Herbarium of the late Arthur Bennett, by the late Mr. C. B. Clarke.

Purchased:—Kneucker, "Gramineae Exsiccatae," lief. xix–xx.

ANTARCTIC REGIONS. *Presented*:—Gough Island, named, by the Scottish National Antarctic Expedition.

EUROPE.—*Presented*:—"Kryptogamae Exsiccatae," Cent. xii.–xiii., by the Imperial Natural History Museum, Vienna: British Florideae, fasc. ii., by Mr. A. D. Cotton; Geheeb, named German Mosses, by Mr. E. S. Salmon; named British Mosses, by Miss A.

Clarke ; rare British plants by Mr. C. E. Salmon ; a small herbarium of European plants collected by the late G. Bentham, by Sir J. D. Hooker, G.C.S.I., C.B.

Purchased :—Adamović, Thrace and Macedonia ; Fiori, Béguinot and Pampanini, "Flora Italica Exsiccata," Cent. iii.–v. ; Sydow, "Mycotheca germanica," fasc. i.–ix. ; Dahlstedt, Scandinavian Hieracia, Cent. xviii.-xix. ; Enander, "Salices Scandinaviae Exsiccatae," fasc. ii.

North Africa. *Presented* :—Egypt, by Mr. W. L. Balls.

Purchased :—Chevallier, Algerian Sahara.

Northern Asia. *Presented* :—Named Tibetan plants, by the Royal Botanic Garden, Calcutta ; Wakefield, Corean Algae, by Mr. A. D. Cotton ; Ssüzew, named Ussuri Mosses, by Mr. V. F. Brotherus.

India and Malay Peninsula. *Presented* :—Named plants from various parts, by the Royal Botanic Garden, Calcutta ; India, named, by Sir D. Brandis, K.C.I.E. ; rare Bombay plants, by Dr. T. Cooke, C.I.E. ; Burmese Dalbergia and Strobilanthes, by Mr. J. H. Lace ; Andaman Islands, by Mr. C. G. Rogers ; Malay Peninsula, by the Botanic Gardens, Singapore ; Impatiens, by Mr. I. H. Burkill.

Malay Archipelago and Indo-China. *Presented* :—Philippine Islands, by the Bureau of Science, Manila ; Philippine Islands, by Mr. A. Loher ; Philippine Islands, by Mr. A. D. E. Elmer ; Williams, Philippine Islands, named, by the New York Botanical Garden ; Philippine Acoridium, by Mr. Oakes Ames ; Borneo and Christmas Island, by the Botanic Gardens, Singapore ; Malay Archipelago, named Orchids, by the Rijks-Herbarium, Leiden.

Purchased.—Hosseus, Siam, partially named ; Elmer, Mount Mariveles, Luzon.

Australasia. *Presented.*—New South Wales, named, by the Botanic Gardens, Sydney ; Hillier, Central South Australia, by Miss Hillier ; named New Zealand Olearias, by Mr. T. F. Cheeseman ; Maltby, Marine Algae of the Chatham Islands, by Mr. A. D. Cotton.

Purchased.—Koch, Western Australia.

Tropical Africa. *Presented* :—Farmar, West Tropical Africa, named, by the Viscount Mountmorres ; Sierra Leone, by Mr. C. W. Smythe ; Lagos, by Mr. E. W. Foster ; Dalziel, Northern Nigeria, by the Imperial Institute ; Southern Nigeria, by Mr. H. N. Thompson ; Southern Nigeria, by Mr. A. H. Unwin ; Southern Nigeria, by Mr. J. C. Leslie ; Benguella, by Dr. F. C. Wellmann ; Sennar and Kordofan, named, by Mr. A. F. Broun ; Drake Brockman, Somaliland, by the Imperial Institute ; Somaliland, by Mrs. Lort-Phillips ; Uganda, by Mr. M. T. Dawe ; Uganda, by Mr. E. Brown ; British East Africa, by Mr. A. Linton ; British East Africa, by Mr. H. Powell ; Grenfell, British East Africa, by Mr. J. S. Gamble, C.I.E. ; Adamson and Buchanan, British Central Africa, named, by the Royal Botanic Garden, Edinburgh ; Allen and Sykes, Rhodesia, by Mr. C. E. F. Allen ; Victoria Falls, by the Rev. Dr. F. C. Kolbe.

MASCARENE ISLANDS. *Presented*: Seychelles and Aldabra Islands, by Mr. R. Dupont.

SOUTH AFRICA. *Presented*:—Named specimens from various parts, by Dr. H. Bolus; named specimens from various parts by Mr. E. E. Galpin; Schlechter, named, by Dr. H. Schinz; Port Elizabeth and Uitenhage, by Miss E. West; Stapelieae, by Mr. N. S. Pillans; Dieterlen, Basutoland Grasses, by Professor C. Flahault; Transvaal, by the Transvaal Museum; Grenfell, Transvaal, by Mr. J. S. Gamble, C.I.E.

Purchased:—Schlechter, Delagoa Bay, etc.

NORTH AMERICA. *Presented*:—Canada, named, by the Geological Survey of Canada; Labrador, by Sir W. MacGregor, K.C.M.G., C.B.; Canada and the United States, named, by the Gray Herbarium, Harvard University; Western North America, named, by the University of Pennsylvania; Abrams, Southern California, named, by the New York Botanical Garden; named Fungi of the United States, by Mr. J. C. Arthur.

Purchased:—Shaw, Selkirk Range, British Columbia; Heller, California; Purpus, Lower California.

CENTRAL AMERICA. *Presented*:—Named specimens, by Capt. J. Donnell Smith; Seler, Mexico and Guatemala, named, by the Botanic Garden, Berlin; Mexico, named, by the United States National Museum.

WEST INDIES. *Presented*:—Jamaica and Bahamas, named, by the New York Botanical Garden; Jamaican Ferns, by Miss A. J. Smith; Cuba, named, by Mr. C. F. Baker; named Mosses, by Mr. E. S. Salmon.

TROPICAL SOUTH AMERICA. *Presented*:—Johnston, Margarita Island, named, by the Gray Herbarium, Harvard University; British Guiana Fungi, by the Botanic Garden, Georgetown; Brownea, by the Natural History Museum, Paris.

Purchased:—Fiebrig, Bolivia; Dusén, Brazil; Ule, Brazilian Fungi.

TEMPERATE SOUTH AMERICA. *Presented*:—Argentine Republic, by Mr. A. Thays.

Purchased:—Dusén, Patagonia.

The principal feature of the year's accessions was the very large number of Philippine plants presented, amounting in all to over 10,000 sheets, or nearly half the total donations. Of these the Bureau of Science, Manila, contributed over 6,500 sheets, and Mr. A. Loher a collection which is estimated at about 3,000 sheets.

Other large collections received were:—a set of Abrams, Southern California plants, containing nearly 1,000 sheets, presented by the New York Botanical Garden; and several sets of Western North American plants, collected by Krautter, Farr and others, containing about 700 sheets in all, and presented by the University of Pennsylvania.

As has been usual in recent years, numerous Tropical African collections were received, none of them, however, of any great size. Among those of special interest might be mentioned Dr. J. M. Dalziel's collection from Northern Nigeria, and that formed by Dr. F. C. Wellman in Benguella.

A noteworthy addition to the European collections at Kew is the set of 900 plants of Thrace and Macedonia, acquired by purchase from the collector, Dr. L. Adamović.

Presentations to the Library during 1906.—The Library is indebted to the Bentham Trustees for the following additions :—*Boudier*, *Icones mycologicae*, of which two series, each consisting of a hundred beautiful coloured plates, and a part of a third, have been issued. The complete work will consist of six series of plates and a thin volume of text. *Sweert*, *Florilegium amplissimum et selectissimum*, 1631, in which all the figures have been coloured, often, it would appear, inaccurately ; on plate 10 of the second part there is a figure of a Monkshood, under the name of *Lycoctonon coeruleum*, the flowers of which are coloured bright red, but in the 1620 edition, which is also at Kew, the flowers of this plant are coloured blue. Bound with the *Florilegium* were 69 plates very similar to those of Sweert's work in execution, entirely without text or clue to their origin. They form, however, a complete set of plates of the *Theatrum Florae* (*Pritzel*, *Thes. Lit. Bot.* ed. 2, n. 10,855), but whether of Mathonière's edition of 1622 or of Firens's edition of 1633 cannot be determined, as they are the same in both editions. The work was issued without text. *Triggs*, *The Art of Garden Design in Italy*, and the continuation of about 20 periodical publications were also presented by the Bentham Trustees.

Professor Hans Schinz has continued to present the numerous publications of the Botanical Museum of the University of Zurich, including *Thellung*, *Die Gattung Lepidium*, and seven dissertations. From Sir W. T. Thiselton-Dyer, K.C.M.G., a further selection of pamphlets from his own library were received, as well as Sir Kenelme Digby's curious work containing the discourses *Of the Powder of Sympathy and of the Vegetation of Plants*, 1669 ; and the *Report of His Majesty's Commissioners for the International Exhibition at Saint Louis, 1904*. The Director of the Botanic Garden, Upsala, Professor F. R. Kjellman, presented a copy of the *Botaniska Studier*, a series of memoirs written and dedicated to him by his students. From the same source were received :—*Rosander*, *Studier öfver Bladmossornas Organisation*, and *Witte*, *Till de Sevenska Alfvarväxternas Ekologi*. A number of papers, elaborated at the Botanical Museum, Hamburg, have been contributed by the Director of that establishment. Sir J. D. Hooker, G.C.S.I., has presented the continuation of several periodicals and serials as in former years. From Mr. George Nicholson the following have been received : *Loddiges*, *Orchidaceae in the collection of Conrad Loddiges and Sons* [1844] ; *H. Mann*, *Catalogue of the Phaenogamous Plants of the United States*, ed. 2 ; *H. Maurer*, *Das Beerenobst*, ed. 2 ; *C. A. Strail*, *Essai de Classification et descriptions des Menthes qu' on rencontre en Belgique* and two other

small works. To Professor J. Matsumura, who has made frequent visits to the Herbarium during the year, the Library is indebted for a copy of the voluminous work on the Flora of Formosa by himself and Mr. B. Hayata; also *M. Miyoshi, Atlas of Japanese Vegetation*, sets i.–vi.; and *M. Miyoshi and T. Makino, Pocket Atlas of Alpine Plants of Japan*, vol. i. Professor Matsumura has also enabled us to complete vol. xi. of the Japanese *Botanical Magazine* of which three numbers were wanting. *F. B. Archer, The Gambia Colony and Protectorate*, was received from His Excellency the Governor of the Gambia; the elaborate reports on the results of the Belgian Antarctic Expedition, from Monsieur G. Lecointe; *T. F. Cheeseman, Manual of the New Zealand Flora*, and the late Mr. C. B. Clarke's annotated copy of his reprint of Carey's edition of *Roxburgh's Flora Indica*, from Miss Aletta Clarke; *S. T. Dunn, Alien Flora of Britain*, from Mr. G. Massee; two catalogues of collections in the Koloniaal Museum, Haarlem, from the Director, Dr. Greshoff; *C. G. Ehrenberg, Sylvae mycologicae berolinenses*, 1818, a scarce work, from Mr. C. G. Lloyd; *G. F. Scott Elliot, A First Course in Practical Botany*, from the publishers, Messrs. Blackie and Sons, Limited; *Sir J. Floyer*, ΦΑΡΜΑΚΟ-ΒΑΣΑΝΟΣ, *or the Touchstone of Medicines*, vol. i., 1687, from Dr. F. Clarke, of Dumfries, through the kind offices of Sir George Watt, C.I.E.; *K. Goebel, Ueber die Biologie der Epiphyten*, and *Ueber die Rhizophoren-Vegetation*, from the Director; *W. Hutchinson, Handbook of Grasses*, from Mr. E. H. Wilson; two pathological papers by Professor Istvanffi, from Dr. M. T. Masters; *B. Daydon Jackson, George Bentham* (English Men of Science), from the publishers, Messrs. J. M. Dent and Co.; *P. E. O. W. Knuth, Handbook of Flower Pollination, translated by J. R. Ainsworth Davis*, vol. i., from the Delegates of the Press, Oxford; *P. Krylow, Flora Altaya, &c.*, i.–iii., from the Director; *A. A. Pulle, An enumeration of the Vascular Plants known from Surinam*, from Dr. F. A. F. C. Went; *Reports on the finance, administration and condition of the Sudan*, 1904 and 1905, from Mr. A. F. Broun; *J. H. Veitch, Hortus Veitchii*, special edition, from Messrs. James Veitch and Sons; *North American Flora*, vol. ii., pt. 1, and *Venezuela, Geographical Sketch, Natural Resources, &c.*, from Dr. N. L. Britton; *Le Bambou*, a new periodical devoted to the Bamboo, from Monsieur J. Houzeau de Lehaie; *Annual Report of the Imperial Department of Agriculture (India)*, 1904–5, from the Superintendent of Government Printing, Calcutta; *Memoirs of the Department of Agriculture, Botanical Series*, and *The Agricultural Journal of India*, from the Inspector-General of Agriculture in India; *Quarterly Journal of the Institute of Commercial Research in the Tropics*, from the Director, Viscount Mountmorres; *Bulletins of the Department of Agriculture, Natal*, from Mr. Claude Fuller; *Der Pflanzer: Ratgeber für tropische Landwirtschaft*, from the Editor; *La Tribune Horticole*, also from the Editor; and *Reports of the British Association for the Advancement of Science*, 1899 to 1905, from the Council. The following works have been presented by their respective authors. *G. E. Anastasia, Le varietà tipiche della Nicotiana Tabacum, L.*; *J. G. Baker, North Yorkshire: Studies of its Botany, &c.*, ed. 2; *F. C. E. Börgesen, The Alga-Vegetation of the Faeröese coasts*; *Conte G. Borromeo,*

Catalogo delle Piante dei Giardini d'Acclimazione delle Isole Borromee; *Sir D. Brandis, Indian Trees*; *M. T. Dawe, Report on a botanical mission through the forest districts of Budda and the western and Nile provinces of Uganda*; *E. A. Finet and F. Gagnepain, Contributions à la flore de l'Asie orientale*; *J. d'Ascensão Guimarães, Monographia das Orobanchaceas portuguezas*; *H. B. Guppy, Observations of a Naturalist in the Pacific*, ii., *Plant dispersal*; *M. Hardy, Esquisse de la géographie et de la végétation des Highlands d'Ecosse*; *S. Jávorka, Species Hungaricae generis Onosma*; *Sir H. H. Johnston, Liberia*; *C. G. Lloyd, The Tylostomeae*; *J. H. Maiden, Wattles and Wattle-barks*, ed. 3; *J. S. Medvedeff, Trees and Shrubs of the Caucasus* (in Russian); *C. A. Menezes, Madeira Ferns, translated by H. Gilbert*; *F. Niedenzu, De genere Hiraea*; *J. Palacky, Catalogus plantarum madagascariensium*; *D. Prain, Noviciae indicae*; *F. Sander and Sons, Orchid Hybrids*; *Sir R. Strachey, Catalogue of the Plants of Kumaon . . . revised and supplemented by J. F. Duthie.* In addition to the above, publications have been received in exchange as in previous years, and a great number of pamphlets have been presented by their respective authors.

Botanical Magazine for December.—The plants figured are: *Aechmea gigas*, E. Morren, *Pontederia cordata*, Linn., var. *lancifolia*, Morong, *Vanda Watsoni*, Rolfe, *Coreopsis Grantii*, Oliv., and *Rhododendron Fordii*, Hemsl. The *Aechmea* is probably a native of Brazil. The Kew plant, which flowered for the first time in March last, was purchased from the widow of the late Prof. E. Morren of Liége. The peduncle bears a number of large crimson bracts, armed on the margin with very numerous sharp teeth, and is terminated by a dense inflorescence of white and pale green flowers. The *Pontederia* flowers annually in the Water Lily House at Kew, where it has been cultivated for many years. It is a native of Temperate America. *Vanda Watsoni* is an attractive species from the interior of Annam, whence it was introduced to cultivation by Messrs. Sander and Sons, of St. Albans, at whose request it was named in compliment to Mr. W. Watson, of Kew. The plate was prepared from material supplied by Messrs. Sander, and from a living plant in the Kew collection previously received from them. It belongs to the small group, characterised by having narrow or acute leaves and racemes of moderate-sized flowers, in which *V. Kimballiana*, Reichb. f., and *V. Amesiana*, Reichb. f., are included. *Coreopsis Grantii*, a species from Eastern Tropical Africa, has elegant deeply cut leaves and rather large bright yellow flower-heads, which are produced in the winter months. The Kew plants were raised from seed received in 1905 from Mr. M. T. Dawe, Director of the Scientific and Forestry Department, Entebbe, Uganda. It requires the protection of a greenhouse in the winter. The *Rhododendron* is a native of Lantao Island, which lies a little to the west of Hong Kong. The plant figured was raised from seed received in 1894 from Mr. C. Ford, I.S.O., F.L.S., who was then Superintendent of the Hong Kong Botanic Garden. The volume of the Magazine just completed is dedicated to H. N. Ridley, Esq., M.A., F.L.S.,

Director of the Botanic Gardens, Singapore, "who, with untiring generosity, has surpassed all recent contributors in enriching the Kew collections with rare and novel plants."

Hooker's Icones Plantarum.—The first part of the twenty-ninth volume of this work containing plates 2801 to 2825, appeared in December. It contains illustrations of five proposed new genera, namely, *Indokingia* and *Geopanax*, Hemsl. (Araliaceae), both from Seychelles; *Neoschimpera*, Hemsl. (Rubiaceae), also from Seychelles; *Sinowilsonia*, Hemsl. (Hamamelidaceae), from China, and *Elaeophorbia*, Stapf, which differs from *Euphorbia* in having a drupaceous fruit, from Western Tropical Africa. Three plates are devoted to the genus *Corylopsis*, and seven species are recorded from China, six of which are new. The Indian specimens of this genus, hitherto regarded as belonging to one species, are here referred to three species. In addition to these there are three or four distinct species in Japan. *Sinowilsonia* is very similar to *Corylopsis* in foliage, but the flowers are unisexual and probably dioicous, though only the females are known. The interesting genus *Clematoclethra*, Planch., is figured and three new species described. *Durandea*, Planch., hitherto very imperfectly known, is fully described by Dr. Stapf, who enumerates 13 species, six of which are new; the rest had been referred to *Penicillanthemum*, Vieill., *Hugonia*, L. and *Ancistrocladus*, Wall. Amongst other noteworthy subjects are *Eryngium pilularioides*, Hemsl. & Rose, *Wielandia elegans*, Baill., *Nepenthes Macfarlanei*, Hemsl., and *Stevia Rebaudiana*, Hemsl.

W. B. H.

Indian Trees.—More than a generation has elapsed since Sir Dietrich Brandis brought out the "Forest Flora of North-West and Central India," begun by Lindsay Stuart, which has in the meantime proved a highly welcome aid to working botanists in India, and the time was ripe for a fresh publication giving the results of subsequent research and information. In "Indian Trees" he has set himself the double task of bringing up to date the matter dealt with in the "Forest Flora," and at the same time adding to it all that might prove interesting to foresters as regards the classification of trees, shrubs, and woody plants throughout the limits of the British Indian Empire, the vastness of which few, perhaps, are better qualified to appreciate than himself. Over 4,400 species are dealt with in the present work, whereas in the "Flore Forestière de la France" of Matthieu, as is pointed out in the Introduction to this new Indian Forest Flora, less than one-tenth of that number has been handled.

Obviously no individual forester could acquaint himself with more than a proportion of these Indian forest products, and the key to the situation lies without question in the gradual drawing up of local Forest Manuals dealing with the known forest products of restricted areas, framed upon professional lines, for working purposes. Sir Dietrich Brandis is disposed to think that the time

when these can be expected may as yet be distant, but the path is being cleared, at all events, by the Government of India through the series of local Indian Floras which, in pursuance of Sir Joseph Hooker's suggestions, are in course of preparation. Mr. Duthie's "Flora of the Upper Gangetic Plain" has reached Campanulaceae, and the "Flora of Bombay," by Dr. T. Cooke, is well nigh completed. At page ix. of the Introduction reasons are given for including many species which from a purely forest point of view might perhaps have been omitted, but in point of fact no apology for this is needed, because it is largely to forest officers that we must look for additions to our knowledge of the living flora in the less known parts of the Empire, more especially in S. India, Burma, and on the North-Western Frontier. Theirs are the most frequent opportunities, and the use already made of these promises well for the future.

No Indian botanist could fail to remember what is due to such workers as Richard Thompson, Beddome, Gamble, Lace, Talbot, Manson, and many younger workers, to say nothing of the distinguished author of this work himself as a systematist and an indefatigable collector. Of work done for Indian botany, in and out of India, by other branches of the public service it is needless here to speak; we may be assured that worthy successors to Buchanan, Wight and Roxburgh, Jones and Colebrooke, Munro, Thomas Thomson, Strachey, C. B. Clarke, Collett, and others who are still with us will never be wanting; but if "Indian Trees," as it ought to, inspires and keeps alive a love of science in coming generations of the Indian Forest Service it will have fulfilled a most important public duty. If a criticism may be offered as regards the systematic aspect of the work, the author seems to have felt more diffidence in approaching points of nomenclature than his reputation and experience as a botanist altogether warranted.

It is true, as is stated at page xi. of the Introduction, that "the change of a name always causes inconvenience, loss of time, and often creates confusion," if the change at least is made needlessly or in contravention of accepted principles; but in many cases, it should be added, practical confusion and economic loss have arisen from the perpetuation of a wrongly cited name, more particularly if, as too often happens, the name wrongly given or quoted conveys or suggests misleading inferences.

In such a case as the supercession of *Mitrogyna* for *Stephegyne*, both of Korthals, some amount of inconvenience must arise temporarily, but for this the author of the names must be held answerable, and not principles, which cannot be infringed without leading to results that are nowhere more to be deprecated than in the domain of applied science in the interests of forestry directly. To take another case quoted in the same passage, it is most undesirable to depart from the usage by which a well-known form of Northern India is described as "Zizyphus Nummularia," if this can be avoided, and unless examples of Lamarck's "Z. rotundifolia" be accessible in Paris, we may feel some hesitation in identifying Wight and Arnott's plant with Lamarck's. But there is a prior question which, if rules of nomenclatnre are to have any force at all, must be first answered, namely, why the

name was ever changed from that of *Z. microphylla*, which, as Wight and Arnott candidly admit, had been duly given it by Roxburgh?

The great merits of the illustrious botanists who deliberately set aside the only valid and, as it happens, perfectly appropriate name in breach of a plain fundamental canon, cannot be accepted as a ground for throwing over an essential principle.

What the plant of the "Encyclopaedia" may have been possibly remains to be seen; that from Wight's country, which is certainly the familiar "Nummularia" of Northern India, is unquestionably *Z. microphylla*, Roxburgh, as the excellent drawing in the Calcutta Herbarium, of which a duplicate exists at Kew, would prove most conclusively were it neeessary to support the description given in the "Flora Indica." In his criticism of the treatment by Mez of the forms grouped in the "Flora of British India" under *Maesa indica*, Sir Dietrich Brandis very justly points out that the results arrived at by a monographer working on often imperfect herbarium material may very likely be at some time modified by other workers with more extended knowledge; but in the meantime something must be done, and the best course, unless we are prepared to give reasons and amend his scheme, is ordinarily, perhaps, to follow the monographer, who has made a family or group his special study. The arrangement of the families, with a few explained departures, follows that of De Candolle as carried out in the "Genera Plantarum" of Bentham and Hooker, an arrangement which brings "Indian Trees" into working correspondence with the "Flora of British India" and the leading English and Indian Herbaria. Synonyms are, naturally, sparingly cited, but reference is given to a published figure where it exists, and a number of inset illustrations, drawn from specimens, add to the utility of the book.

In conclusion, his many friends will join in congratulating the author on the successful conclusion of his eight years' labour, and the issue of a work which should prove of great assistance not only to foresters, but to other civil officers, and also, in spite of the disclaimer in the Introduction, to all interested in the Floras of the different Provinces and Dependencies of India.

J. R. D.

The Orchids of the North-Western Himalaya.—The second part of the ninth volume of the *Annals of the Royal Botanic Garden, Calcutta*, the Preface to which is dated February, 1904, is wholly devoted to descriptions and figures of the orchids of the North-Western Himalaya, by J. F. Duthie, B.A., late Director, Botanical Department, Northern India, and now Assistant for India in the Kew Herbarium. The area comprised under the above designation lies between 28° 45′ and 36° N. lat. and 71° 30′ to 80° 40′ E. long., and extends from Kumaon on the east to the frontier territories of Gilgit, Chitral, and Hazara on the west.

This is a valuable and interesting contribution to orchidology, and Mr. Duthie is to be congratulated on having had the services of

so competent an artist as Mr. H. Hormusji Deboo, whose work is indeed excellent, and one is glad to see his name commemorated in *Eulophia Hormusjii*, Duthie. A similar compliment is paid to Inayat Khan, an enthusiastic and very successful native collector, in *Listera Inayati*, Duthie.

Incidentally it may be mentioned that the orchid flora of India, Northern India more especially, has now been almost fully illustrated in the *Annals*. Part i. of vol. v. contained "A Century of Indian Orchids," by Sir Joseph Hooker, and vol. viii. is wholly devoted to "the Orchids of the Sikkim Himalaya," with 448 plates, by Sir George King and Mr. R. Pantling.

The following particulars of the North-Western Orchids are mostly taken from the author's "Introduction." Up to the present time 173 species of orchids have been collected within the limits described above. Of these, 114 are terrestrial and 59 are epiphytal, and 24 are peculiar to the region, or at least, they have not hitherto been found outside of its limits. Several of the last category are described for the first time. One collector of specimens, Mr. Philip Mackinnon, F.L.S., contributed no fewer than nine previously undescribed species, discovered by him and his native collectors in the neighbourhood of Mussoorie. There are 58 plates, representing as many species, and only such species as are not figured in the volume on the Sikkim orchids. No fewer than 105 of the western species extend to Sikkim, and 35 to China. A noteworthy fact in this connection is the wider distribution of species of orchids than was formerly supposed, as shown by recent investigations. Twelve of the species are found in Ceylon. *Pholidota imbricata* and *Spiranthes australis* extend to Australia, and *Epipactis gigantea* and *Goodyera repens* re-appear in North America, whilst 10 British species also occur in North-West India, namely, *Listera ovata*, *Corallorhiza innata*, *Goodyera repens*, *Spiranthes autumnalis*, *Epipogum aphyllum*, *Epipactis latifolia*, *Cephalanthera ensifolia*, *Orchis latifolia*, *Herminium Monorchis*, and *Habenaria viridis*. Forty-five genera are represented; none of these are endemic. The most numerously represented are:—*Habenaria*, 31 species; *Dendrobium*, 15; *Liparis* and *Eulophia*, 9; *Cymbidium* and *Herminium*, 7; and *Coelogyne* and *Goodyera*, 6 species. On the other hand, 18 of the genera are represented by one species each.

The genus *Cymbidium* divides naturally into leafy and leafless species, which are, however, very uniform in floral structure. *C. macrorhizon*, Lindl., is a remarkable representative of the latter group. It was originally described from Kashmir specimens, but it is now known to inhabit the mountains eastward to Assam, Khasia, and Naga. The flowers are not easily distinguished from those of the leafy *C. lancifolium*, Hook. It has been described as a root-parasite, but there is no evidence of this in the specimens at Kew. Indeed, the fleshy, branched, hairy rhizomes suggest that it is of saprophytic nature.

Cymbidium Mackinnoni flowers in mid-winter near Mussoorie at an elevation of 5,000 feet, within the region of heavy snowfall. An allied species, *C. cyperifolium*, is found in similar situations, but always under the shelter of trees, where it comes into flower

in March and April, though it is recorded as flowering in Sikkim in November. Some of the normally terrestrial species are more frequently found on the trunks of trees than in the ground; among them *Habenaria latilabris* and *H. Elisabethae*, and *Herminium Mackinnoni* has never been found growing in the ground.

W. B. H.

The Ceylon Rubber Exhibition, 1906.—The following brief account of this exhibition has been received from Dr. J. C. Willis, Director of the Royal Botanic Gardens, Peradeniya, in his capacity as Chairman for publication of the results of the exhibition. Dr. Willis reports that a detailed handbook of the exhibition will shortly be published :—

An extremely successful Exhibition of Rubber has lately been held (September 13th–27th) in the Royal Botanic Gardens at Peradeniya, Ceylon, and marks a distinct stage in the progress of this great new industry, an industry which owes it inception and progress entirely to the forethought and aid of scientific men at the various Botanic Gardens of Kew, Ceylon, and Singapore.

Extensive buildings were erected in the Kandyan (or Sinhalese mountaineer) style of architecture, and were well filled with exhibits of raw rubber in its different forms from the plantations of Ceylon, the Malay Peninsula, and India, tools for the tapping and collecting of latex, manufactured rubber and rubber goods, and other things, besides exhibits of raw rubbers from all corners of the globe. Two large sheds were also filled with machinery for the treatment of the latex, and there were interesting side shows as well.

We do not propose to go into details as to the exhibits, but to give some of the chief facts connected with the industry, and some of the chief lessons learnt at the exhibition.

Ten years ago there was practically no rubber in cultivation of the 'Para' kind (*Hevea brasiliensis*), the kind that is now almost exclusively attended to. Seed was then all but impossible to obtain, and though a small "boom" in this product took place in Ceylon in 1898–9, the supply of seed was too small to allow it to go far. Only since 1902 has there been plentiful seed and the industry has expanded very rapidly till now in Ceylon there are about 110,000 acres, in Malaya about 60,000, and in other countries probably 40,000, say 200,000 acres in all, to say nothing of perhaps 100,000 acres (of *Castilloa elastica*) in Mexico.

The primitive methods of tapping the trees in V's with a hammer and chisel have now gone out, and the favourite methods are to cut spirals or herring bones on the trees, and pare the edges of the cuts at intervals of from 2 to 10 days, thus getting the advantage of the wound-response discovered by the writer in 1897 and worked out in detail by Mr. Parkin in Ceylon in 1898–9. The second tapping of a given area gives more latex than the first, and the amount often continues to increase for some time.

For paring the cuts there were many knives exhibited, and gold medals went to the Bowman-Northway and Miller knives, both of which are simple, keep sharp, and pare thin shavings without any dragging of the cut edges. It is very important that the shavings should be thin, as the bark should be made to last about four years before it is all cut away, in order to allow the renewed bark time to ripen fully.

The yields obtained on some estates have been phenomenal, but it is probable that in many of these cases the bark has been too rapidly cut away, and that a period of waiting for the renewed bark to ripen will ensue. It is not as yet safe to count on more than a pound a year a tree, if so much, but even this means 150–200 lbs. an acre, an amount sufficient at present prices to yield an enormous profit.

Hitherto the Ceylon rubber has mostly appeared upon the market in the form of "biscuits"—flat pancakes about 10 inches in diameter. The Malayan has mostly been in "sheets" about 2 feet long. But both these forms seem destined to disappear in favour of block—rubber prepared by blocking the sheets, biscuits, or other form under high pressure. Some samples of block were shown by Lanadron Estate, Johore, and similar samples have lately been getting the highest prices on the market.

The Ceylon and Malayan rubber has been obtaining higher prices per pound than any of the "wild" rubbers, even "fine Para," the standard of the market, but pound for pound of pure rubber is really getting lower prices, for the Para rubber contains about 20 per cent. of moisture. Why this should be so is one of the greatest problems before the investigation at the present moment.

Anyone comparing a sample of fine Para with one of any plantation rubber—Ceylon, Malayan, or Mexican—can see at once that the former is more springy, returning more readily to its original shape when stretched. The higher price really obtained for this rubber may therefore probably be explained on this consideration.

Now is it because the trees are young that the rubber is weaker, or because the rubber is not smoke-cured? Is it because the rubber is in biscuit or sheet instead of in blocks? Is it that it is too much dried (Para rubber contains 20 per cent. of moisture)? Is it that it is too pure and too much washed? Or is it that it is not coagulated in the best way? All these, singly or in combination, are possible explanations, and there may be others.

There is no doubt that older trees give stronger rubber, but that of even the oldest trees in Ceylon—30 years old—is not equal to South American rubber. Smoke-curing (without coagulation at the same time) seems to strengthen the rubber, and block rubber, besides its saving in cost of freight, and exposure of less surface to oxidation, seems actually stronger than sheets or biscuits. The great dryness of the plantation rubber may also have something to do with it, and experiments are now being tried by the Peradeniya institution in the preparation of block from wet biscuits.

To anyone looking forward a little, one of the most interesting exhibits in the show was the vulcanised and coloured rubber exhibited by Mr. M. K. Bamber, Government Chemist in Ceylon. Mr. Bamber acts, not on the coagulated and macerated rubber, but directly on the latex with the necessary reagents, and then coagulates, giving a perfect intermixture.

The coagulated rubber can then be worked up into whatever is required in the ordinary way, and finally heated, when it vulcanises. One of the most promising of his exhibits was the mixture of fibre and rubber. The fibre, cleaned, is soaked in sulphurised rubber milk, coagulated and then dried, and finally subjected to hydraulic pressure and vulcanised, the result being blocks suitable for pavement, &c. By this method rubber can also be turned out of any colour desired, and the colour will not wash or crack off—a great advantage for children's toys. One of the most noteworthy features of the Exhibition was a series of daily lectures on the various parts of the rubber industry—cultivation, tapping, shipment to London, vulcanisation, catch-crops, pests, &c., &c., and these lectures, with the reports of the judges, description of the machinery, and other things, are now being put together into a book, which will form a standard treatise,* to be in the hands of everyone interested in rubber.

Seeds from Crops of Wild Ducks.—A quantity of seeds taken from the crops of three species of Wild Duck have been submitted for identification by Mrs. C. J. Cornish, from Steyne, Bembridge, Isle of Wight. The ducks were shot on Brading Harbour Marshes. "With the exception of a few minute shell-fish," writes Mrs. Cornish, "the contents of the crops consisted entirely of seeds similar to those sent." The seeds in question were found to be those of *Zostera marina*, L. The few shells present, on being sorted out, proved to belong to *Paludestrina stagnalis*, a species of brackish water, with those of *Rissoa*, also inhabiting brackish water, and of *Nassa*, inhabiting truly marine localities. The two genera last mentioned are very critical, and it is possible that more than one species of each genus may be represented in the collection. In a subsequent note on the subject, Mrs. Cornish has been so good as to add the information that *Zostera marina* does not grow in the marshes where the birds were actually shot. They are fresh water or brackish marshes. The plant, however, Mrs. Cornish states, "grows freely in the Harbour, outside the Embankment." The three species of Wild Duck from which the seeds were taken were Pochard, Widgeon, and Common Mallard. The crops of Teal killed at the same time were quite empty.

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* The Ceylon Rubber Exhibition Handbook, by J. C. Willis, M. K. Bamber, and E. B. Denham. To be obtained from Dulau & Co., 37, Soho Square, or Messrs. Wyman & Sons, Limited, Fetter Lane, London, for 7*s.* 6*d.*, net.